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LIGHT ✂ HEAT ✂ POWER ✂ BYE-PRODUCTS

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Editorial Notes.

Varying Circumstances of the Coal Industry.

THE choice of subject by Mr. Charles A. Goodall for his address last week as Chairman of the Society of British Gas Industries was particularly happy, when the coal industry is being again subjected to one of its periodical upheavals. Anyone who helps us to understand anything about the working of the industry is rendering service, and Mr. Goodall's address is an excellent summary of what is being done to-day with coal at the pits before it reaches the market. It is, incidentally, a good illustration of the immense difficulty of treating the whole industry as one unit for purposes of marketing, wages, or any other. In an instructive table in the paper, we see the great diversity in percentages of coal washed and cleaned by the various districts, and these must be to a large extent determined by the nature of the coal produced and by the market conditions with which each district has to contend. And we must give colliery owners credit for knowing something of their own business. The consumer, be he gas engineer or any other, may claim that collieries will certainly get a better price for clean coal, which is probably true to some extent. But interest on capital expenditure for screening plant, cost of internal transport, grading of coal, and other items connected with cleaning plants in their present state of development, amount to an additional cost which many colliery owners have considered in recent years and been obliged to reject.

It is always as well to look at both sides of a case, and, while fully supporting the universal cry for clean and consistent coal, we cannot help reading the colliery owners' viewpoint through Mr. Goodall's excellent statement of facts. The grading and cleaning of coal is, as he explains, making steady progress in this country, but a demand for universal treatment in this way would be unreasonable when, as we know to be a fact, many collieries in Durham still have seams from which they can turn out unscreened gas or coking coals with a regular 6 p.ct. ash by hand-cleaning on the picking belt.

The Institution Meeting.

TO-DAY'S Supplement to the "JOURNAL" is a report of those proceedings of the Institution Meeting devoted to discussion of the possibilities of using creosote in the manufacture of carburetted water gas, and of the Refractories Report presented to the Institution last June. We also commence publication of the Ammonia Report.

Creosote is a falling market, and huge stocks have accumulated. An idea of the gravity of the situation is gained from the fact that a decrease of one penny per gallon in the price of tar means a loss of about £800,000 annually to the gas industry, or a halfpenny per 1000 c.ft. of gas. As the President, Mr. C. S. Shapley, remarked in opening the session, the financial return from tar products generally represents more than one-third of the total income from residuals. Hence the urgent need for exploring new avenues for the disposal of creosote, and hence the *raison d'être* of the Twenty-Fourth Report of the Joint Research Committee of the Institution and the University of Leeds.

Dr. Dent, the Research Chemist, with commendable brevity, outlined the report, explaining that it is a compilation of data obtained by previous workers, prior to a laboratory study of the cracking propensities of creosote. Two series of tests on the large scale are described in the report, one carried out by the British Gas Light Company at Hull, and the other by the Gas Light and Coke Company. The results of the two investigations, which are fully recorded in our columns to-day, are in agreement, and they do not give rise to optimism regarding the future of creosote as a water gas enriching medium. The yield of gas obtained from creosote when used alone is small compared with that obtained from gas oil, and the practical difficulties due to naphthalene blockages render the process impracticable as carried out under present conditions. Mixtures of gas oil and creosote containing not more than 10 p.ct. of creosote can be employed without mechanical difficulties arising, but at present there is absence of data indicating the performance of the creosote itself.

Light creosotes are better than heavy creosotes, but we have yet to learn how good they really are. It will be noted from the report that in one test admixture of creosote to gas oil actually reduced the amount of gas which normally would have been yielded by the gas oil content alone. This is not very surprising. Much work has been done lately, notably by Hollings and Pexton, and by Griffith, on the cracking of gas oil; and it is clearly demonstrated that the yield of gaseous therms per gallon rises to a maximum and then decreases steadily as the cracking temperature is raised. Poor cracking results are obtained above or below the optimum temperature. Also, the rate of oil feed is a most important factor in the cracking efficiency; here also there is an optimum rate. It is easy to see, therefore, that the addition of creosote can have the effect of altering the rate of feed of the gas oil—less quantity of the latter being passed in a given time—and thereby reducing the yield of gaseous therms. This indicates the need for studying the requirements of creosote just as the requirements of gas oil have been investigated; and Griffith has shown that laboratory work in this respect is an accurate guide to large-scale operation. The results of the trials which are to be made at Leeds University—trials which will be ap-

proached "scientifically, in a neutral frame of mind," albeit without any great feeling of optimism as to the findings securing a remunerative outlet for creosote—will be valuable, and will be awaited with interest.

Suggested Outlets for Creosote.

In view of the restrained tone of the report, it was natural that during its discussion suggestions should be forthcoming regarding alternative outlets for creosote. Mr. John Wilkinson mentioned the possibility of dividing it into two fractions—one for use on the gas-works, the other for power purposes in an internal combustion engine of the Diesel type. Mr. Sensicle wondered whether it would be worth while endeavouring to crack the creosote for benzole, and then to scrub this out of the water gas. Mr. Rhead spoke of the use of creosote as a fuel, giving it a value of a halfpenny per gallon in comparison with coke dust, but suggesting that, in competition with more expensive fuel, the transaction might assume a different complexion. On this aspect of the matter, Mr. Wright cited his experiments, which indicate that, for burning under boilers, 3 tons of creosote is equal to about 5 tons of coal.

Storage difficulties were dealt with by several speakers. "Creosote," remarked Mr. Firth, "can be anything in a tar works. The creosote tank in a tar works is the dump for unclassified oil." Therefore, if creosote is going to be used for carburetting, extra storage facilities will be necessary, and this factor will increase the cost of production. Mr. P. N. Langford expressed the hope that the Research Committee will consider the necessity for a stringent specification for creosote intended for cracking; otherwise the hasty who put their creosote into big storage tanks will live to rue the day. Finally, we would call attention to Mr. Firth's pertinent observation that advantage might accrue from investigation into the treatment of creosote in an atmosphere of steam. This suggestion is certainly well worthy of close consideration.

Refractory Materials.

The session was brought to a close by presentation and discussion of the Report of the Refractory Materials Joint Committee which was adopted by the General Research Committee last May. Before asking Dr. Colman to read Mr. Dale's summary of the report, the President had the sad announcement to make of an accident to Mr. Leather, who, as Chairman of the Refractories Committee, has done such sterling work for our industry. We referred to this accident in the "Journal" last week; and we repeat here our good wishes for his speedy recovery. It will be remembered that Mr. Leather retired from the Chairmanship a few months ago. Dr. Colman has consented to occupy this office—a decision which met with unanimous approval and thanks at the meeting on Nov. 13. Mr. Dale's summary will be found in our Supplement to-day; and we may remind our readers that in the "Journal" for July 17 and 24 were published two important sections of the Refractories Report, one dealing with the effects of temperature on heat-insulating bricks, and the other with after-expansion and true specific gravity of silica refractories for carbonizing plant.

The outstanding feature of the lengthy discussion was the contribution by Mr. Edwards, who pointed out that a perfect insulating material—made from kieselguhr—is rendered imperfect by its manufacture. It is not kilned to a temperature which will reduce the contraction at 1000° C., for the simple reason that this implies more trouble in shaping. Mr. Edwards has had experience of one type of perfect insulating brick—alas, it is a Continental product. He emphasized the value—indeed, the necessity—of applying long-period soaking tests to all refractory materials, even though this may shatter a fool's paradise. He also had much interesting information to impart concerning jointing cements and hot-patching materials. For silica sections, he pins his faith to a quartzite cement, and as a plasticizer uses cellulose liquor. On setting, this cement has a stone-like texture, and the results are much better than when burned silica or ground silica brick is employed. This opinion is at variance with that of Mr. Rhead, who said that "a counsel of perfection is to use a jointing material made from burned silica." Mr. Edwards told the meeting why he was unable to agree with some of the statements made in the report as to the desirable properties of hot-patching cements.

Mr. Rhead urged the Committee to raise the temperature of the specific gravity test to 1500 C., mentioning that material which will pass the test at 1410° often shows as much as 1 or 2 p.ct. after-expansion at 1500°. Col. Carr expressed the hope that further research will be made in regard to the conductivity of refractories. At Stretford he installed simultaneously three identical settings—one in fireclay, one in silicious material, and one in 95 p.ct. silica. They were set to work on the same day, and have now been operating under the same conditions for two years. Eventually the results should yield valuable practical information on the subject. The spalling of retorts on scurfing came in for considerable comment; Mr. Copp suggesting that one of the causes of spalling in the vertical retort is the heat transfer between the inside of the retort and the combustion chamber. At times, when the coal descends, there are probably marked variations of temperature, sometimes perhaps below the critical temperature of silica. Another factor put forward by Mr. Copp is the use of washed fuel containing appreciable quantities of salt.

Once again we have only skimmed the surface of the discussions, in order to give a general impression of the meeting. The proceedings throughout certainly justified the President's conviction that nothing but good could accrue from discussion of research reports which hitherto have been sadly neglected in open conference.

Complete Gasification.

It is obviously an ideal that gas suppliers should distribute gaseous fuel solely, for gas is a more refined source of energy, and far more easily regulated, than solid fuel, however smokeless the latter. Moreover, with gas, there is no question of fuel storage and ash disposal as far as the consumer is concerned. Hence the fascination of any contribution dealing with the total gasification of coal, and hence the more than ordinary interest attaching to the paper by Mr. Pearce before the Southern Association of Gas Engineers and Managers at their meeting in London on Friday last. The plant he described is no will-o'-the-wisp. We inspected it a few months ago at the Mill Hill Works of the North Middlesex Gas Company, and described it in the "Journal" for March 13, p. 727. Incidentally, it is manufactured by a firm of gas constructional engineers—Messrs. Humphreys & Glasgow, Ltd.—who are as conservative in their claims as they are efficient in their workmanship.

We are convinced that the plant at Mill Hill is an efficient engineering job, and that it is capable of dealing with almost any type of coal. We believe that its advent has strengthened the hand of the gas industry if in future residual markets are wholly adverse. Thermal efficiency, we think, has little to do with the matter; and in any case the thermal efficiency of gas production *per se* in the plant under review is not intolerably different from the figures advanced for normal gas-works practice by the Clerk-Smithells-Cobb report of 1919, and revised by Sir Dugald Clerk in 1924. Frankly, we are a trifle weary of this "thermal efficiency" myth. So is every gas engineer in the country. He knows full well that the fate of the industry depends on cheap gas. What would it avail the industry if gas were sold at £1 per therm, with, be it noted, 100 p.ct. thermal efficiency, as proved by super-experts in all the universities in the world.

The whole question, therefore devolves on the one point—Can the Humphreys & Glasgow complete gasification plant at the moment produce a therm more cheaply than the two-stage process of carbonization and water gas pro-

duction? And it is unfortunate that Mr. Pearce adduced no figures to show that complete gasification gas is cheaper than any other. Those who attended the meeting were left with the feeling that the plant is efficient, but they obtained little guidance. Time and time again "local conditions" have covered a multitude of omissions concerning financial working; the paper on Friday last was no exception. Our industry is in urgent need of costs figures relating to complete gasification; and those who favour the system may rest assured that a low price per therm will overshadow any ethical efficiency idea.

We are all in favour of Dr. Colman's tests, and we admire Mr. Trewby's feeling that no experimental plant at the Mill Hill Works should be talked about or seen which was not a mechanical and chemical success; but we are still left completely in the dark regarding costs per therm. Even the discussion on the paper shed no light on this all-important point, though it evoked a wholesome irritant to the static idea of comfortable gas production. Mr. Moon as an idealist, Mr. Whimster as a matter-of-fact politician, Mr. Stewart as a student of data—alas, in spite of all, Mr. Pearce was non-committal. We are left with the idea we had last March, that the Humphreys & Glasgow plant at Mill Hill is thoroughly efficient, and that Mr. Trewby knows his business in installing a second and improved unit.

Oil-Cracking.

FOR many years we have put gas oil into our carburetted water gas sets, and we have raised the calorific value of the gas made; only recently, however, have we decided that clear ideas of the mechanism of the carburetting process were not only desirable, but necessary commercially. In our note on the Institution meeting, referring particularly to the employment of creosote in carburetted water gas plants, we mentioned the valuable work of Hollings and Pexton, and of Griffith, which has done so much to elucidate the problem of utilizing gas oil efficiently. This work was not lost sight of by Mr. A. G. Grant, of the Gas Light and Coke Company, in a paper which he read on this subject before the London and Southern District Junior Gas Association last Friday. His paper was a valuable review of the whole process of carburetting, and lack of space alone prevents our publishing his contribution *in extenso*. Incidentally, the Association are doing good service to the industry in their encouragement of what we may without discourtesy term "the young idea." It is a good idea, for the younger generation of the industry is attacking problems fundamentally.

There are oils and oils, says Mr. Grant; and we agree. And we are with him too when he points to the fact that progress in the oil combines is all against therms in carburetted water gas. He shows this graphically and in tabular form by the work of others and incidentally by his own researches. We want "open-chain" bodies in gas oil; and whether or not we can purchase them, we ought to be able to evaluate them. Griffith has shown the way; and some of Mr. Grant's figures indicate the variation in composition, and in gas producing quality, of oils which conform to the normal specifications for distillation, gravity, and so on.

Cracking temperature, time of contact, atmosphere, method of oil admission—these are the factors which determine the efficacy of the oil carburetting process. The influence of each factor is dealt with clearly by Mr. Grant; and his paper should do much to help others to appreciate their significance and to increase carburetting efficiency. Looking to the future, the author is of opinion that, if any extensive alteration takes place in carburetting practice, it will probably be in the direction of utilizing inferior oils, rather than in an attempt to obtain greater efficiency from oils of the present-day type; and he thinks that low-temperature tar oils have distinct possibilities from the carburetting point of view. In our reference to the Institution meeting, we mentioned the suggestion put forward by Mr. Firth that good might come of study of creosote cracking in an atmosphere of steam. The same idea regarding low-temperature tar oils is advanced by Mr. Grant; and it deserves consideration.

Our Supplements.

We are fully anticipating that some of our subscribers will again this week protest that we are setting them too hard a task in the amount of technical fare which is placed before them for mental digestion. Those who may feel like this we would forestall in their protests by an expression of regret at the lavishness of the "fare," and a suggestion that the "consumer" should regard himself as confronted with a choice of dishes, somewhat after the style of "Thick or clear soup?" which has been with us from time immemorial. Many readers will turn first of all to this week's supplement recording the afternoon proceedings on the opening day of the autumn meeting of the Institution of Gas Engineers. It will be well worth their while to do so. As great a number will select for a start the "Gas Salesman" supplement. It will be equally well worth their while; for there will be found in it varied items of interest to the man on the selling side. A large proportion of the readers will make the "JOURNAL" proper their first love, and not one will feel that his choice has been a bad one. A problem is discussed there which has long intrigued the industry—the complete gasification of coal—and there is an address which has a close bearing upon a troublesome present-day problem. These are only two matters; there are many others. Indeed, though we feel it would be too much to ask subscribers to study everything offered, not one will fail to find something which makes particular appeal to him.

A League of Industries.

With Viscount Cecil of Chelwood in his place as President at last week's luncheon of the Society of British Gas Industries, it was only natural that some reference should be made to his labours in connection with the League of Nations. He has worked hard in a great cause, and any opportunity of recognition is to be welcomed. The point, however, which we have in mind in referring to the matter here is that which was alluded to by the President in his response. What has all along puzzled him is how it is that people who are most strenuous advocates of peace among nations do not seem always to carry out these views when it comes to industry. That same thing must have puzzled many other people. It is in passing from the expression of general views to the consideration of particular cases that the real test of sincerity comes about; and it is by the actions of each one in regard to matters which lie to his hand that the value of his views on wider issues must be appraised. The world will soon be a better place if all who cry "Peace!" will also strive for it. Until there is the clearest evidence that they are doing so, doubts on the score of sincerity cannot be wholly stifled. Such evidence would be provided by following Lord Cecil's suggestion of a League of Industries, in the sense of a league of all those engaged in industry. As he said, the two things are on all fours in every respect; and only sincerity is needed to create what he hopes for—a League of Industries as powerful and as successful as the League of Nations could ever hope to be.

"S.B.G.I." Activities.

The report of the Chairman of the Council (Mr. C. A. Goodall) on the work of the Society of British Gas Industries during the past six months shows that steps have been taken which promise a bounteous crop of good results, in addition to the large amount of work for the industry that has been already accomplished. Co-operation with other bodies is taking place in various useful directions. Among these is the British Industries Fair, Birmingham, where, on Feb. 18, 19, and 20 next, there is to be a joint conference with the other national organizations of the industry on similar lines to last year. On the first day of this conference, the Society will contribute a paper on "Gas Lighting"—a subject in which they are taking keen interest. The decision to offer a gold medal for the best paper before a Gas Salesmen's Circle is one which will be highly appreciated among a class of men whose work, perhaps more than any other, stands to gain from the genial influence of encouragement.

Position of Sulphate of Ammonia.

There will be found in this issue the yearly analysis of the position of sulphate of ammonia, in which the British Sulphate of Ammonia Federation, Ltd., quote figures certain of which, so far as the gas industry is concerned, will doubtless have a less pleasing complexion than was at one time the case. It will be seen that the world production of pure nitrogen in the form of bye-product sulphate of ammonia was in 1928-29 little more than in the immediately preceding year, though that in the form of synthetic sulphate of ammonia increased greatly. This particular table includes the last six years, during which period the world production of pure nitrogen in the form of synthetic sulphate of ammonia has more than doubled—from 231,100 to 485,000 metric tons—while the increased output of pure nitrogen as bye-product of sulphate of ammonia has grown from 264,600 to 376,000 metric tons. The output of nitrogen as Chilean nitrate of soda was 100,000 metric tons up in the past twelve months, as compared with the year 1927-28. The report points out that, considering the difficult position of agriculture, the increase of 230,000 tons of nitrogen in the world's consumption during the year under review must be regarded as satisfactory. The statistics reveal the increasing tendency for production to outrun consumption; and for 1929-30, we are told, a further considerable increase in production is expected. The need for sustained efforts to stimulate consumption is therefore apparent. Home sales of sulphate of ammonia show a gratifying increase, as compared with preceding years; and no one will doubt the correctness of the claim that this has been due to the cumulative effect of the advisory work undertaken.

Sweet Reasonableness.

The way of the pylon, like that of the transgressor, is apt to be hard, judging by an evidently well-informed article contributed to the pages of an electrical contemporary. The attitude of owners and tenants, when approached on the subject of wayleaves, can be placed broadly in one of three categories—ready agreement, open to persuasion, or definite refusal. The last-named, of course, represents the "snag;" and "something has to be done about it." It may be explained that the neighbourhood has asked for a supply of electricity; but the recalcitrant one, with certain recent proceedings in mind, may ask for chapter and verse. Should further argument be called for, it may be urged that, after careful survey, it has been found the line must pass over his property, so that, if he still refuses, it will be necessary to seek compulsory powers. It may be pointed out that, if he will now give his consent, his wishes will be met, so far as is possible with regard to the positions of the poles, whereas, if compulsory powers are obtained, "you will please yourself where the poles are placed." One hardly knows whether to sympathize more with the negotiator or with the obstinate landowner. One thing, however, which does seem certain is that, if there are very many cases of this character, the popularizing of overhead transmission electricity supply will also, like the way of the transgressor, prove hard.

FORTHCOMING ENGAGEMENTS.

[*Secretaries of Gas and Kindred Organizations are asked to assist in making this diary of events as complete and useful as possible by sending the earliest intimation of all meetings.*]

Nov. 30.—LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.—Visit to the Greenwich Tar Works of the South Metropolitan Gas Company in the afternoon.

Dec. 7.—WESTERN JUNIOR GAS ASSOCIATION.—Visit in the morning to the works of the Horstmann Gear Company, Bath. In the afternoon adjournment will be made to the Offices of the Bath Gas Company, where a paper will be read by Mr. H. W. Willmer on "Gas Sales Policy."

Dec. 12.—SOUTHERN ASSOCIATION OF GAS ENGINEERS AND MANAGERS (EASTERN DISTRICT).—Meeting at 28, Grosvenor Gardens, S.W. 1.

Dec. 17.—SOCIETY OF BRITISH GAS INDUSTRIES.—Council Meeting in the afternoon.

PERSONAL.

At a meeting of the Gas Committee of the Nottingham Corporation which was held on Friday last, Alderman Sir ALBERT BALL was elected Chairman for the twenty-third year in succession; Mr. R. E. ASHWORTH being re-appointed to the Vice-Chairmanship.

Congratulations to Councillor J. FERGUSON BELL, J.P., M.Inst.C.E., upon the recognition of his long and valued services that is indicated by his appointment as a Director of the Derby Gas Light and Coke Company, in which position he will doubtless be able to accomplish still more in the interests of the undertaking. He is to retain the post of Chief Engineer and General Manager. Mr. Bell went to Derby from Stafford in 1900 as Chief Engineer, and he later took over the General Managership. In 1925 he was President of the Institution of Gas Engineers, of which he has been a prominent member since 1884. He is also a member of the Institutions of Civil Engineers and of Mechanical Engineers, and was for two years Chairman of the Derby Society of Engineers. His knowledge of water engineering also has been specially valuable to the town in his position of Chairman of the Water Committee. Except for a break of two years, Mr. Bell has been a member of the Council since 1913, and he was appointed a Justice of the Peace for the Borough in 1925. He is a member of the Derwent Water Board, and of the Derby Education Committee.

We learn with regret that Dr. E. W. SMITH has felt it necessary to resign his Treasurership of the Society of Chemical Industry. We understand that this step has been made inevitable owing to pressure of work in other directions. His retirement will be a real loss to the Society, not only because of the keen and unbiased intellect which he brings to bear on all problems presented, but also because of the energy which characterizes everything he undertakes.

Mr. N. A. BIRKS, A.M.I.Mech.E., has recently become a partner in the firm of Abbott, Birks, & Co., 113, Newington Causeway, S.E. 1.

OBITUARY.

The death has taken place of Mrs. MARY LEWIS, wife of Mr. John T. Lewis, Engineer and General Manager of the Wellingborough Gas Light Company, Ltd.

The death has occurred, at the age of 72 years, of Mr. THOMAS STOKES, for 37 years Secretary of the Thirsk (Yorkshire) Gas Company and for the past seven years a Director of the Company. There was a large attendance, including the Directors, Manager (Mr. H. Foss), and others associated with the Gas Undertaking, at the funeral at Sowerby, near Thirsk, on Nov. 13.

Dr. SAMUEL RIDEAL, D.Sc., F.I.C., who was well known as a chemist and an expert on sanitary science, died suddenly on Nov. 13, at the age of 66. Deceased devoted himself to the study of water purification and sewage, as well as disinfection and food preservation. His "Practical Inorganic Chemistry," "Disinfection and Disinfectants," "Water and Its Purification," "Public Water Supplies" (with his son, Dr. Eric Rideal), "Sewage and the Bacterial Purification of Sewage," and "Industrial Chemistry," appeared between 1889 and 1918.

SOCIETY OF BRITISH GAS INDUSTRIES.

A Meeting of the Council was held at 56, Victoria Street, Westminster, S.W. 1, on Nov. 20—Mr. C. A. GOODALL, the Chairman, presiding. Those present were: Mr. Frank West (Vice-Chairman), Dr. E. W. Smith (Hon. Treasurer), Major R. Miles, Col. E. A. Wilson, Messrs. R. J. Milbourne, J. W. Scott, A. B. Balmford, E. J. Fox, R. B. Hodgson, S. Cutler, H. E. Bennet, F. C. Tilley, G. J. Jackson, B. B. Waller, Ernest West, E. J. Davison (Hon. Secretary), and Arthur L. Griffith (Secretary). Apologies for absence were reported from Messrs. H. M. Thornton, Geo. Clark, F. J. Gould, D. M. Gibb, W. J. D. Howell, and C. R. F. Threlfall.

An application for membership was submitted from the Horstmann Gear Company, Ltd., Bath, and they were unanimously elected members of the Society under Section VII.

The appeal from the Joint Fuel Committee for support for the Standardization of Tar Products Tests Committee Guarantee Fund towards the expenses in connection with the publication of the book "Standard Methods of Testing Tar and its Products" was considered, and it was resolved that the Society should guarantee the sum of £20.

A letter was submitted from Sir John Cass Technical Institute stating that they had decided to establish a Consultative Committee to advise them on the further development of their Courses in Fuel Technology, and inviting the Society to nominate a representative on the Committee.

Dr. E. W. Smith was appointed the Society's representative on the Committee.

SOCIETY OF BRITISH GAS INDUSTRIES.

AUTUMN GENERAL MEETING.

The Autumn General Meeting of the Society was held last Wednesday, at the Hotel Metropole, Northumberland Avenue, W.C.2. The business proceedings were preceded by a luncheon, at which the Right Hon. Viscount Cecil of Chelwood (the President) occupied the chair. There sat with him at the top table Mr. Charles A. Goodall (Chairman of the Council), Sir Robert Hadfield, Bart., F.R.S., Sir David Milne-Watson, LL.D., D.L., Sir Arthur Duckham, G.B.E., K.C.B., Mr. Frank West (Vice-Chairman of the Council), Mr. R. J. Milbourne, J.P., Assoc.M.Inst.C.E., Mr. Charles Clare, Mr. Samuel Cutler, Assoc.M.Inst.C.E., Mr. Robert H. Thomson, Dr. E. W. Smith, F.I.C., Mr. J. Wilfrid Drake, Mr. Percy F. Holmes, J.P., Mr. R. B. Hodgson, Mr. B. B. Waller, Assoc.M.Inst.C.E., Mr. Cyril G. Davis, Mr. Frederick C. Tilley, Mr. E. J. Davison (Hon. Secretary), and Mr. Arthur L. Griffith (Secretary).

After the luncheon, there were a few speeches. The Loyal Toast having been honoured,

The President.

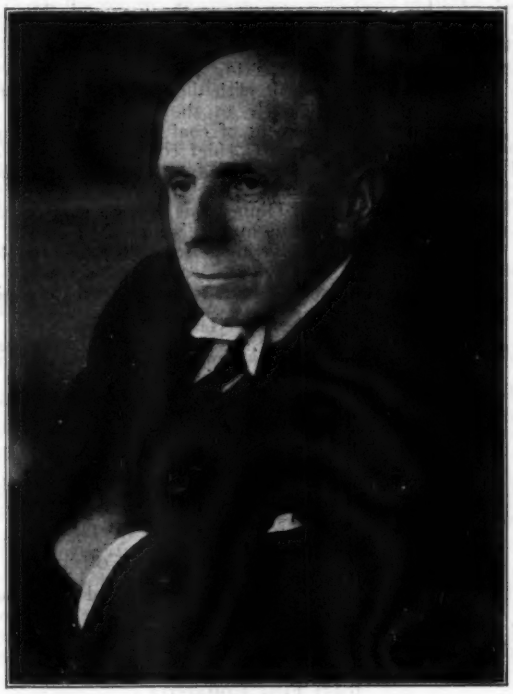
Mr. C. A. GOODALL said that at the autumn meeting they did not have a long list of toasts at the luncheon, but there was one which they always honoured, and he was sure that day it would be received by the members with enthusiasm. The toast was "Our President, the Right Hon. Viscount Cecil of Chelwood." It gave him very great pleasure to have the honour and privilege, as Chairman of the Council, to propose this toast. The Society, since its inception, had been most fortunate in having been able to secure as its Presidents from year to year men distinguished in all spheres of life. This year the members were again extremely favoured in having as their head one who added lustre to their long list of Past-Presidents; and in proposing the toast (which was indeed no mere formal one) they did wish to say as a Society how much they appreciated the honour which had been done them—that, out of his busy life, Lord Cecil had accepted the position and given his time to be with them that day. The name of Lord Cecil had been known to the public for many years. In connection with the political world he had held many high offices of State. He had also been Chancellor of Birmingham University and Rector of Aberdeen. From the inception of the League of Nations, he had devoted his time and services to its advancement and progress, and by his writings and speeches had been one of the strongest influences in securing for the League the position and status in which it now stood; and he (Mr. Goodall) was sure the members wished that the cause of peace which the President was striving to establish would be crowned with success. As a Society, their aims and objects were to develop their industry on the lines of progress, in the purifying of the atmosphere, in the elimination of waste of coal and valuable bye-products, and in providing for the warmth, light, comfort, and betterment of the nation as a whole; and when they were supported by such eminent men as the present President, and those who had occupied the chair before him, they were encouraged to continue with the work of the Society to improve the useful service which had been rendered by the gas industry as a whole for over a century.

A League of Industries.

Viscount CECIL said the Chairman had spoken most kindly of him, and had indicated that he thought the members owed him (the President) a debt of gratitude because he had accepted the office. This was not at all his own view of the situation. He was extremely glad to be associated with that Society, and, indeed, with any Society which had at heart the promotion of the prosperity of the industries of this country. It was a great mistake to regard industry and politics as essentially distinct. The man in politics and the man in industry were, indeed, pursuing different lines of thought, but essentially, if they were doing their duty, they were both working for the prosperity of the country, and indirectly for the prosperity of the world. Unless they were doing this, they had no business either in industry or in politics. Therefore, to say that he was anything but honoured by being asked to be their President, was to mistake the whole situation. The Chairman, in his observations, had said that one of the objects of this particular Society was not only to promote the prosperity of the industries connected with it, but to promote the purity of the atmosphere. This was, in his judgment, a very urgent need in this country. He quite recognized the economic difficulties that were in the way; but he did honestly believe there was no single thing that could contribute more to the happiness and good health of all classes in the community than to work and live in an atmosphere undefiled by yellow fog and smoke. If this could be achieved—and their Society were the people to achieve it, if it could be done—they would be performing an enormous service. The Chairman had referred also to his (the President's) work in connection with the League of Nations. This had been of enthralling interest; but there was one thing that had always puzzled him, and this was how it was that those people who were the most strenuous advocates of peace among nations did not seem always to carry out these views when they came to industry. To his mind, the two things were absolutely on the same footing, and those who believed that the nations owed any allegiance to the common interest ought equally to believe that all classes of the community, workmen and employers alike, really had the same interests, and should be working together. The two things seemed to be on all fours in every respect; and he earnestly hoped that they might see a League of Industries, in the sense of a league of all those engaged in industry, as powerful and as successful as the League of Nations could ever hope to be. He thanked them most heartily for their kindness to him that day.

The Vice-Presidents.

Mr. FRANK WEST (Vice-Chairman of the Council) next proposed the toast of "The Vice-Presidents," who, he said, had added great lustre to the Society. Leading men in various spheres of life had given the Society of their best in the past, and were continuing to do so at the present time. They had not only acted as Chairmen of their meetings, but they had contributed very much to the Society's transactions. They had present with them that day one or two of the Past-Presidents, who had contributed extraordinarily valuable matter. He would mention Sir David Milne-Watson, who unfortunately had had to leave for another meeting, Sir Robert Hadfield, and Sir Arthur Duckham. It was very good of these gentlemen who helped the Society in the good work. He was going to couple with the toast the name of Sir Robert Hadfield; but before doing so, he would like to refer to a letter from Prof. Smithells, who said it was with very great regret that he was unable to be with them, as he had to be in Court.



THE RT. HON. VISCOUNT CECIL OF CHELWOOD,
President of the "S.B.G.I."

Sir ROBERT HADFIELD remarked that it gave him great pleasure to be present, and to be allowed to say a few words, because he had no more pleasant recollections than of the time when he was President of their Society. It was a delight to him to give any help he could. His Presidency occurred during the war, when everyone was working very hard; but the fact that something like 2000 copies of his address were printed and distributed showed, he ventured to think, that he had been able to offer them technical data of some value. The President had done splendid work in the directions alluded to by the Chairman; but one fact not mentioned was how proud England was of his great father, Lord Salisbury. He was speaking not in a political sense only, but chiefly because of the great devotion Lord Salisbury had to science. He had his own laboratory in his private house. This reminded him that he himself had once tried to emulate that. His father allowed him to put down in a cellar a small experimental steel furnace, and one day he nearly burned the house down; but he acquired some useful information

which was of service to him later, just as Lord Salisbury did magnificent work in the laboratory. He wished the Society continued success.

BUSINESS MEETING.

The Business Meeting was afterwards held in the Hotel. At the commencement of the proceedings, Viscount CECIL occupied the chair; but on his having to leave, Sir ARTHUR DUCKHAM took his place.

Mr. C. A. GOODALL (Chairman of the Council) read the following:

Report of the Chairman of the Council.

At the Autumn Meeting it is usual for the Chairman of the Council to give a short résumé of the work of the Society during the past six months.

It is with much regret that we have to record, during that period, the death of the following members: Messrs. R. A. Hepworth (Managing Director, R. & J. Dempster, Ltd.), T. V. Miles (Director, Newton, Chambers, & Co., Ltd.), Robert A. Morrison (Director and Secretary, Stewarts & Lloyds, Ltd.), H. Douglas Burn (Managing Director, Metropolitan Gas Meters, Ltd.), and Henry N. Bickerton (Chairman and Founder of the National Gas Engine Co., Ltd.).

The Society wishes to offer its hearty congratulations to two of our Past-Presidents: His Grace the Duke of Sutherland, K.T., on his appointment by His Majesty the King as a Knight of the Order of the Thistle; and Sir Arthur Duckham, K.C.B., G.B.E., on the conferment on him by His Majesty the King of a Knight Grand Cross of the Order of the British Empire for his services as Leader of the Economic Mission to Australia.

The Most Hon. the Marquis of Hartington, M.P., our Past-President, at the Annual Meeting held in April, gave us a very able address which dealt with the present aspects of coal carbonization, and particularly to the rival merits of high and low temperature treatment of coal as the basis of profitable conversion of coal and its chief components—gas, coke, and tar. We are indebted to him for the same and also for his services as our President.

The Annual Meeting and Dinner was again a very successful function, and we had with us many distinguished guests. We are this year honoured by having as our President the Right Hon. Viscount Cecil of Chelwood, and we can assure him that we very much appreciate his having accepted the position.

THE INSTITUTION OF GAS ENGINEERS.

We congratulate the Institution on the grant by His Majesty the King of a Royal Charter, and extend to them our best wishes for increased prosperity and usefulness to the gas industry.

BRITISH COMMERCIAL GAS ASSOCIATION.

We also wish to offer congratulations to the above Association on their very successful Conference held at Eastbourne last month, at which several of our members were present.

NATIONAL GAS COUNCIL—GAS SAFETY COMMITTEE.

The Society has co-operated with the National Gas Council, and important evidence was given by Mr. F. W. Goodenough, C.B.E., on behalf of the gas industry before the Board of Trade Committee on Oct. 10.

JOINT FUEL COMMITTEE.

The Society has accepted an invitation to join the Joint Fuel Committee, and the Chairman, Vice-Chairman, and Immediate Past-Chairman have been appointed as our representatives.

SMOKE ABATEMENT LEAGUE OF GREAT BRITAIN.

The Society gave its patronage to the Smoke Abatement Exhibition held in Manchester this month.

BRITISH INDUSTRIES FAIR, BIRMINGHAM, 1930 (GAS INDUSTRIES SECTION).

The Society, in co-operation with the Institution of Gas Engineers, the British Commercial Gas Association, and the National Gas Council, are again organizing the Gas Industries Section which is to form part of the British Industries Fair, Birmingham, from Feb. 17 to 28, 1930.

In connection with the Fair, arrangements are to be made for a new Conference Hall to be erected on the North side of the present Fair buildings, and also for the removal of the dining-room which abutted the Gas Section last year.

A Local Sub-Committee has been appointed to deal with the matters relating to stand fittings and layout, and it is suggested that the colour scheme and basis of stand design shall be similar to that used at the last Fair.

Arrangements are also being made for the holding of a Joint Conference at the Fair on Feb. 18, 19, and 20, 1930, on similar lines to last year, when papers will be contributed on each of the three days. The Society will contribute a paper on "Gas Lighting" on the first day of the Conference.

STANDARD CONDITIONS OF CONTRACT.

The Institution of Gas Engineers has set up a Committee to consider the suggested modifications recommended by the Society.

RETORT SETTERS.

The relations of Section I. with the Amalgamated Union of Building Trade Workers have continued to work harmoniously.

REFRACTORY MATERIALS.

During the summer, the opportunity of visiting refractory works in America was given to the majority of the members of Section X. Mr. W. J. Gardner, President of the Ceramic Society, and a large party inspected some 30 works, and were able to obtain the latest American ideas as to the usage and manufacture of refractories. Mr. Frank West, our Vice-Chairman, took a very active part in arranging the tour and making it a success.

The British Refractories Research Association has continued its work on refractory materials for the gas industry, and great and continuous progress has been made with problems connected therewith. During the year the gas industry has obtained fuller representation on the Council. Several of the members of the Section took a prominent part in the Annual Meeting of the Institution of Gas Engineers, and their contributions may be found in the Institution proceedings.

THE CHAIRMAN,
Mr. C. A. Goodall.

Mr. Goodall was Secretary of Messrs. Graham Morton & Co., Ltd., from 1898 to the liquidation of that Company, after which he carried on the business in partnership with Mr. W. B. Leech and in association with Messrs. Clayton, Son, & Co. as Leech, Goodall, & Co., until Mr. Leech left to take up the position of Gas Engineer at Leeds in 1914. After this dissolution of partnership, the Company was registered as a Limited Company under the present name of Goodall, Clayton, & Co., Ltd.; and he has been Managing Director since its formation.

The Refractory Materials Joint Committee has held several meetings at which important matters were fully discussed, and many of them afterwards referred to the Research Association for investigation, while the interests both of the gas industry and of our members have been closely studied.

GAS LIGHTING.

The Joint Committee consisting of Members of the British Commercial Gas Association and Members of Section VIII. of the Society met in October and discussed the position of gas lighting in the industry and the advisability of introducing suitable advertisements in the Press with a view to popularizing the same. Steps are now being taken by the Committee to bring the various forms of gas lighting to the notice of the public.

GAS COAL SECTION.

The Coal Section have held meetings, when the coal situation generally was discussed, particularly in connection with

the proposed organized marketing schemes which are at present under consideration by the Government.

GAS SALESMEN'S CIRCLES.

A Joint Committee has been appointed to consider the rules under which the award is to be made, of the gold medal offered by the Society, for the best paper of the year dealing with the technical side of the gas industry, contributed by members of the Salesmen's Circles.

EXAMINATION PRIZES.

The prizes in the City and Guilds of London Institute Examinations in Gas Works Practice, Gas Supply Practice, and Gasfitting have been duly awarded and announced in the Technical Press.

REVISION OF RAILWAY CLASSIFICATION OF GOODS.

Messrs. Tweedy & Holt, our railway experts, of Halifax and London, continue to watch our interests, and their reports keep us in touch with railway matters.

MEMBERSHIP.

We are pleased to report that the membership of the Society is steadily increasing, new firms having joined in the period under review, and, at the present time, there are other applications under consideration by the Council.

CONTINUANCE OF USEFUL WORK.

Mr. GOODALL, having read the report, proceeded: In moving the adoption of the report, I do not know that there is very much which requires comment from me. I am sure, however, in the first place, it will be your wish, as a mark of respect to the several members of the Society who have passed away during the period, that we should rise and stand for a moment.

As regards the report, this, I think you will agree, shows that the Society is continuing to do useful work for the industry in its own particular sphere, as well as in conjunction with the Kindred Associations. The several Joint Committees of the Institution of Gas Engineers in connection with the research work continue to function. The question of gas lighting is receiving serious consideration, and we are taking our part on the Committees of the British Commercial Gas Association in the good work they are doing for the industry. As mentioned in the report, the Society has again organized the Gas Section at the British Industries Fair, to be held in Birmingham in February next year. In conjunction with the Institution of Gas Engineers and the British Commercial Gas Association, arrangements are being made for a Joint Conference on Feb. 18, 19, and 20, 1930. We trust that all members of the Society will make a special effort to visit the Fair, and be present during these days.

Terms have now been drawn-up for the award of the gold medal which the Society is offering to the Gas Salesmen's Circles for the best paper of a technical character. We trust that the award of this medal will be a further encouragement to the useful work the Circles are doing. I now move the adoption of the Council's report.

Mr. FRANK WEST seconded the motion, which was unanimously agreed to.

THE PRESIDENT'S SERVICES.

Sir ARTHUR DUCKHAM said the President had to leave them, in order to attend to other urgent duties, and they would all like to thank him for his kindness to the Society. It was invaluable to them to have men like their President, who would devote the time necessary to come among them, listen to their difficulties and aspirations, and advise them as to the best methods of achieving their objects. They looked forward to hearing in a little while many words of wisdom from Lord Cecil. They wanted something to think about; they wanted inspiration; they wanted a finger pointing ahead. They were inclined, perhaps, to be a little despondent; and he was certain they would have from the President that enthusiasm, that statesmanship, that thinking ahead which had enabled him to accomplish so much for the country in connection with the League of Nations.

The vote of thanks having been carried by acclamation,

The PRESIDENT said that, by his speech, Sir Arthur had placed upon his shoulders a very heavy responsibility, which he would do his utmost to discharge.

COAL HANDLING.

Mr. GOODALL then delivered an address entitled "Coal Handling." This, together with the report of the discussion to which it gave rise, will be found elsewhere in this issue of the "JOURNAL."

GAS STOCK AND SHARE MARKET.

[For Stock and Share List, see later page.]

GREATER confidence was noticeable on the Stock Exchange last week than for some time past, and prices showed more positive signs of recovery. Early in the week the more normal conditions that existed on the New York Exchange contributed to the improvement, while the reduction in the Bank Rate on Thursday provided a fresh stimulus. In the gilt-edged market considerable interest was shown in the new 5 p.ct. Conversion Loan. Dealings commenced at a small discount; but the opportunity of acquiring the stock on better terms than the issue price ceased after a few hours.

Caution was exercised in the Industrial Market owing to anticipated difficulties over the Account settlement, and at the close of the week an irregular tendency prevailed.

The Gas Market was stronger than it has been for some weeks. Transactions were about normal; and it will be noticed from the Stock and Share List that the only stocks marked down were *ex* div. quotations. On the other hand, European shares advanced 2½ points to 12½-14½; Imperial Continental capital jumped 15 points to 330-350; and Primitiva ordinary recovered 1s. to 28s.-31s. Some attention was given during the week to Commercial ordinary, which stands at the attractive figure of 90-95, dealings being recorded at 92-92½. This Company has distributed 6 p.ct. for the years 1927 and 1928; and on the assumption that this rate will be maintained, the yield on the higher figure is £6 9s. 9d. p.ct. Another attractive investment is Oriental capital stock, which, at the average quotation of 110½ *ex* div., yields on the 8 p.ct. dividend paid for many years £7 4s. 9d. p.ct.

The following transactions were recorded during the week:

MONDAY.—Croydon max. div. 78, 79, European 11, 11$\frac{1}{16}$, 11$\frac{3}{16}$, 11$\frac{3}{8}$, 12, 12½, Gas Light and Coke 17s. 7½d., 17s. 9d., 18s., 18s. 1½d., 18s. 3d., 3½ p.ct. max. 61¼, 4 p.ct. pref. 73, 73¼, 74¼, 3 p.ct. deb. 57½, Imperial Continental 320, 322, 325, 326, 327, 328, 330, Primitiva 29s. 6d., South Metropolitan 99½, 99$\frac{3}{4}$, 100½, Tuscan 6 p.ct. deb. 70. Supplementary prices, Brighton and Hove 4 p.ct. deb. 72, East Surrey 7½ p.ct. deb. 100, Eastbourne "B" 102, Liverpool 5 p.ct. 93.

TUESDAY.—Croydon sliding-scale 105, 105½, max. div. 78, 79, European 11$\frac{1}{16}$, 13, 13¼, 13½, 13$\frac{3}{4}$, Gas Light and Coke 17s. 10½d., 18s., 18s. 1½d., 4 p.ct. pref. 73¼, Imperial Continental 317, 317½, 320, 322, 323, 324, 325, Metropolitan (of Melbourne) 5½ p.ct. deb. 93½, Primitiva 28s. 6d., 4 p.ct. cons. deb. 80½, 81, South Metropolitan 99½, 99$\frac{3}{4}$, 3 p.ct. deb. 55, Tottenham 3½ p.ct. 105½. Supplementary prices, Barnet 4 p.ct. deb. 72, 72½, Liverpool 5 p.ct. 92½.

WEDNESDAY.—Bombay 16s. 3d., 17s. 7½d., Bristol 85, Colonial 8 p.ct. pref. 21s. 6d., Gas Light and Coke 17s. 10½d., 18s., 18s. 3d., Imperial Continental 320, 322, 323, 324, 325, 327, Metropolitan (of Melbourne) 5½ p.ct. deb. 92¼, 93¼, Primitiva 29s., 29s. 3d., South Metropolitan 99½, 100$\frac{3}{4}$, 3 p.ct. deb. 54½. Supplementary prices, Wakefield 5 p.ct. 72½.

THURSDAY.—Bombay 17s. 7½d., British 5 p.ct. deb. 96½, European 12$\frac{3}{4}$, 12$\frac{7}{8}$, Gas Light and Coke 18s., 18s. 1½d., 18s. 3d., 18s. 4½d., 4 p.ct. pref. 73¼, 5 p.ct. deb. 99¼, Imperial Continental 318, 323, 324, 325, 326, 327, 328 *ex* div., Liverpool 7 p.ct. pref. 99½, San Paulo 6 p.ct. pref. 9, South Metropolitan 100, 101, 6 p.ct. pref. 106½, South Suburban 5 p.ct. 101½, 102, Supplementary prices, Associated 45½, Metropolitan (of Melbourne) 8$\frac{3}{4}$.

FRIDAY.—Commercial 92, 92½, Croydon sliding-scale 105, European 13, 13¼, 13½, Gas Light and Coke 17s. 10½d., 18s. 3d., 5 p.ct. deb. 98½, Imperial Continental 325, 327, 328, 330, 331, 332, 333, 335, 337½, 340, 342, 345, South Metropolitan 6 p.ct. pref. 107¼, 3 p.ct. deb. 56, 6½ p.ct. deb. 99, 99$\frac{3}{4}$, Uxbridge 5 p.ct. 97½, 98. Supplementary prices, Kingston-upon-Thames 102½, 103, York consolidated 4 p.ct. 65, 66.

At the week-end, though money was in good demand in Lombard Street, rates were distinctly easier than during the previous days. Old loans were renewed at 4½ p.ct., and fresh advances were secured at from 4½-4$\frac{3}{4}$ p.ct. The fact that Treasury Bills were allotted at an average of only £4 16s. 8·14d. p.ct. contributed to the fall in discount rates. It is satisfactory to note that the average was no less than 12s. 6·78d. p.ct. below that of the previous week.

Foreign Exchange movements were unimportant. At the close the New York exchange was slightly lower at 4.87$\frac{3}{16}$; French francs closed at 123.89; and German marks were quoted at 20.38$\frac{7}{8}$. Italian lire at 93.14½, and Dutch florins at 12.68$\frac{5}{8}$, were less favourable to sterling. Spanish pesetas depreciated to 35.10, and Belgas remained at 34.87½.

Silver was dearer at 22$\frac{13}{16}$d. per oz.; while Gold, of which there was an influx from South America, was quoted at 84s. 11½d., after being down to 84s. 10$\frac{3}{4}$d. per oz.

The Bank Rate is 5½ p.ct., to which it was reduced from 6 p.ct. on Nov. 21. The Banks' deposit rate is 3½ p.ct., and the deposit rates of the Discount Houses are 3½ p.ct. at call and 3$\frac{3}{4}$ p.ct. at notice.

SOUTHERN ASSOCIATION OF GAS ENGINEERS AND MANAGERS.

General Meeting in London.

A General Meeting of the Association was held at the Hotel Cecil, W.C. 2, last Friday—Mr. W. E. DEAN, of Exmouth (the President), in the chair.

The minutes of the previous meeting (as published in the "JOURNAL") were taken as read, and confirmed.

The PRESIDENT said he was sorry to have to refer to the loss of three members since their last meeting—Mr. T. S. F. Gibson, Mr. Charles Hunt, and Mr. A. H. Richardson. He asked the members to show their sympathy by standing silently, and this they did.

ELECTION OF NEW PRESIDENT.

The PRESIDENT said his next duty was that very pleasing one of proposing the election of his successor. As they were aware, the position of Vice-President was at present occupied by a gentleman whose name was an honoured one in the gas industry—Mr. Frank Jones, who had lately presided over the conference of the British Commercial Gas Association at Eastbourne. That conference was a pronounced success, and he felt sure that, when the time came for Mr. Jones to occupy the chair of their Association, he would do equally good work for them. His ability and enthusiasm would make him an excellent President. During his own year of office, he (Mr. Dean) had done the best a provincial man like himself could do for the Association.

Mr. R. ROBERTSON (Bristol) said he felt it a privilege to second the election of Mr. Frank Jones as President. He thought that as an Association they were very fortunate indeed in having a gentleman of Mr. Jones's qualifications to fill the chair. The association of his family with the industry had been a long one, and his own attainments had brought him into the front rank of gas administrators.

The proposal having been carried with acclamation,

Mr. JONES said he was very sensible of the honour that had been done him in electing him President. The gentleman who occupied the chair at present was much too modest in referring to himself as merely a provincial man. He did not subscribe to the view that the provinces were in any way inferior to London. Wherever they might go, they would be unlikely to find a works of better general appearance than those of Mr. Dean at Exmouth. He could assure the members that he would do his best for the Association.

THE NEW VICE-PRESIDENT.

The PRESIDENT said he had reserved for himself the pleasure of proposing the Vice-President, because the gentleman whose name he was going to submit had done so much good work for the Association—he referred to their esteemed Hon. Secretary, Mr. H. C. Smith, of Tottenham. A year ago, Mr. Smith intimated to the General Committee that he wished to give up the office of Hon. Secretary, as he thought these duties, if they could find a successor, should go round. When he told them that he would like to resign, it occurred to him (the President) that they should not lose the value of his services to the Association by letting him drop right out, and that the best thing they could do would be to ask him to accept the nomination for the Vice-Presidency. This Mr. Smith did, and he felt sure that the Association would be served by him equally as well as they had been during the time of his Hon. Secretaryship. He at present filled the position of President of the Eastern Counties Association.

Mr. T. CARMICHAEL (Portsmouth) seconded the proposition, remarking that they all knew Mr. Smith, and realized that he had done an enormous amount of work for the industry. In this connection he might refer to what he had done in the matter of the securing of the Royal Charter and the work of the Education Scheme, and also as an Examiner. It was impossible to speak too highly of his work as Hon. Secretary of their Association during the last five years, and they could not find a more eligible Vice-President.

Mr. SMITH, after the proposition had been heartily agreed to, said he could only thank the members very much for the honour they had done him. The interests of the Association were very close to his heart, and he would always do everything he possibly could to further these interests. The time he had spent as Hon. Secretary had been extremely enjoyable, but he did think there should now be a change. These offices should not be regarded as anything in the nature of a permanency. He would like to tell them that, when he went to Mr. Frank Jones and asked him if he would allow his name to go forward as Vice-President, Mr. Jones, who was about the busiest man in the industry, without asking how much work was involved or what were the responsibilities, said: "I will do anything I possibly can if it is good for the gas industry." That was the sort of enthusiasm that must take the industry on from strength to strength.

GENERAL COMMITTEE, DISTRICT COMMITTEES, AND DISTRICT EDUCATION COMMITTEES.

The HON. SECRETARY reported the following elections by the Districts:

EASTERN DISTRICT, 1930.

Chairman.—Mr. J. Urquhart.
Vice-Chairman.—Mr. T. Carmichael.
Hon. Secretary.—Mr. W. H. Warren.
Committee.—Messrs. A. H. Andrews, C. Valon Bennett, W. H. Bennett, D. C. Cross, H. Gage, W. Grogono, L. G. Humphrys, S. Lacey, L. J. Langford, E. L. Nicholas, F. Porteous, C. T. Price, R. H. Ruthven, C. H. Rutter, W. J. Sandeman, E. F. Smallbone, A. W. Sumner, J. Terrace, J. S. Thorman, and L. Trewby.
Ex-Officio Members of the Committee.—The President, the Vice-President, and the Hon. Secretary for the time being of the Association.
Representatives on the General Committee in place of those retiring by Rotation.—Messrs. D. C. Cross, S. Lacey, and W. J. Sandeman.
Representatives on the District Education Committee of the Institution of Gas Engineers.—Messrs. D. C. Cross, H. Gage, W. Grogono, and S. E. Whitehead.

WESTERN DISTRICT, 1930.

Chairman.—Mr. J. Armstrong.
Vice-Chairman.—Mr. R. J. H. Clark.
Hon. Secretary.—Mr. J. B. Cattle.
Committee.—Messrs. J. Hughes Cornish, C. G. Dawson, W. E. Dean, S. E. Halliwell, C. Harris, H. Higham, P. S. Hoyte, J. H. Lowther, J. Harger Pye, H. E. Riley, C. Stapleton, J. Taylor, A. Thomas, H. W. Versey, E. P. Vince, and W. N. Westlake.
Ex-Officio Members of the Committee.—The President, the Vice-President, and the Hon. Secretary for the time being of the Association.
No representative on the General Committee due to retire in 1929.
Representatives on the District Education Committee of the Institution of Gas Engineers.—Messrs. J. Armstrong, C. Harris, R. Robertson, and W. N. Westlake.

ELECTION OF HON. AUDITORS.

On the motion of Mr. P. G. G. MOON (Bournemouth), seconded by Major J. E. BLOW (London), Messrs. James Donaldson and John Urquhart were re-elected Hon. Auditors.

THE SECRETARYSHIP.

Mr. H. C. SMITH proposed the election of Mr. J. H. Donaldson, of Sevenoaks, as Hon. Secretary. He said that when he intimated at the end of last year his wish to resign this position, the Committee stipulated that he must find someone to follow him. He thereupon approached Mr. Donaldson, who said he would be only too pleased to do anything he could for the Association. He was undoubtedly going to make a good Hon. Secretary.

Mr. JAMES TAYLOR (Weston-super-Mare) seconded, with the remark that Mr. Donaldson was an efficient officer of the Sevenoaks Gas Company; and the high esteem in which he was held was indicated by the fact that to his position of Engineer, Manager, and Secretary had been added that of Managing-Director of the Company. They were particularly fortunate in being able to nominate for the position of Hon. Secretary of their Association the Managing-Director of a gas company.

Mr. J. H. DONALDSON, acknowledging his election, said he accepted the office with a certain amount of trepidation, as he was certain it would be very difficult to follow such an excellent Secretary as Mr. Smith.

NEW MEMBERS.

The following new members were elected, on the proposition of the PRESIDENT, seconded by Mr. FRANK JONES.

John Gerald Abbott, Windsor.
Harry Clifford Dunbar, Hemel Hempstead.
Robert William Foot, Gas Light and Coke Company.
Frederick Stanley Larkin, Gas Light and Coke Company.
James Robertson, Tottenham.
Arthur Tennant, East Surrey Gas Company.

PRESENTATION OF CERTIFICATES.

The PRESIDENT then presented the certificates to the following successful candidates in the Higher Grade Examinations

in Gas Engineering and Gas Supply of the Institution of Gas Engineers:

Gas Engineering.

C. Fuller Petersen	1st Class
Douglas N. McCaskill	2nd Class
Herbert Wm. Moys	,, ,,
J. A. Nicholls	,, ,,
Charles W. Rogers	,, ,,
L. A. Ross	,, ,,
Eric A. Ryder	,, ,,
Jackson Summerson	,, ,,

Gas Supply.

Lancelot F. Randall	1st Class
William J. Westbrook	,, ,,
Horace J. R. Tucker	2nd Class

The PRESIDENT said it was a source of gratification to find there were so many recipients of certificates. He would like to take this opportunity of wishing them all success in their future life. He hoped the time would come when they would be seen at the head of the profession.

Mr. C. F. PETERSON said that, on behalf of his fellow students and himself, he would like to let the members know how much they appreciated having been invited there to receive their certificates.

COMPLETE GASIFICATION PLANT AT MILL HILL.

The PRESIDENT then called upon Mr. F. J. Pearce, of the North Middlesex Gas Company, to read "Some Notes on the Complete Gasification Plant at Mill Hill." He remarked that the installation was unique, and the preparation of the paper must have involved much time and trouble. They were, therefore, greatly indebted to him for coming forward with his contribution.

VOTE OF THANKS TO THE PRESIDENT.

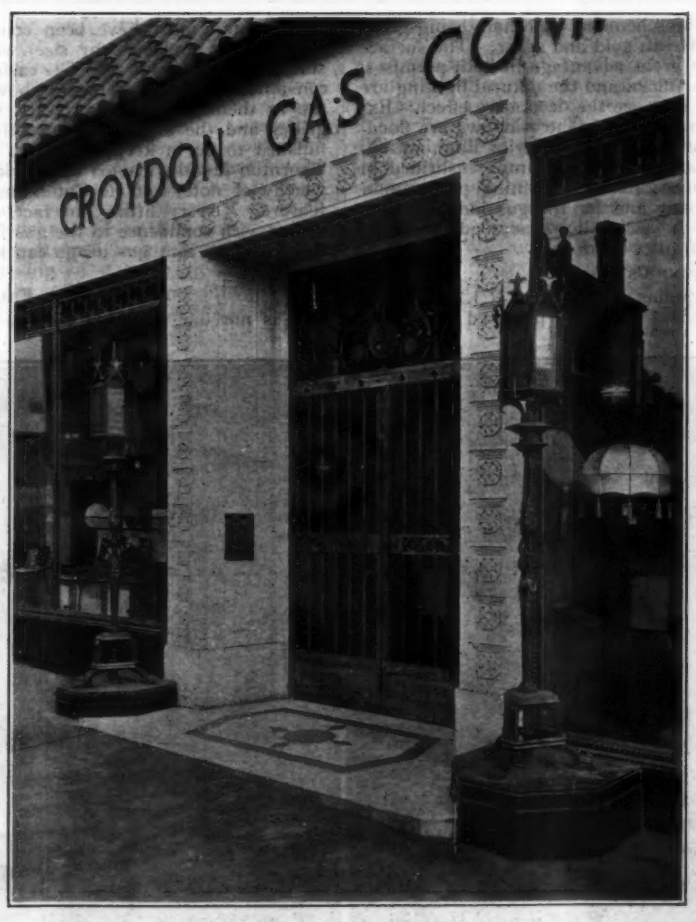
Mr. A. E. BROADBERRY said they had now come to the last item, which was a vote of thanks to the President. He was glad to have the opportunity of proposing this, because it carried his mind back a great many years to the time when the President went to Tottenham as a pupil. There he carried out his duties right from the start in a manner that made those connected with the Company take an interest and pride in him. From the beginning he was not only a pupil, but he was a leader. When Mr. Dean came to the conclusion that the time had arrived for him to go further afield, he went with the best wishes of the Tottenham Company, who had ever since followed his career with interest. The Association were proud of him as President, and were grateful to him for the way in which he had guided their affairs during his year of office.

Mr. J. R. H. JACOBS (Southampton) seconded, and, referring to the President's remark that he was only a man from the provinces, reminded him that he came from the West Country, which had provided the Association with a number of greatly respected Presidents. Mr. Dean's conduct in the chair entitled him to rank with the best of them.

The PRESIDENT'S acknowledgment brought the meeting to a close, and the members adjourned for tea.

NEW SHOWROOMS AT CATERHAM AND THORNTON HEATH.

Success of the Croydon Gas Company's Sales Enterprise.



THORNTON HEATH.

Recently we availed ourselves of the opportunity of inspecting two remarkably attractive district showroom premises which the Croydon Gas Company have erected in their area of supply. One is at Caterham, a growing district which promises to yield much business, and comprises stores and fitting shops as well as showroom proper; it is, in other words, a district depôt. The other is at Thornton Heath. Both are excellently situated. At Caterham the premises occupy a large corner site in the centre of the town and opposite the railway station; while at Thornton Heath the showroom is in the main shopping thoroughfare.

DECORATIVE EFFECTS.

The photographs which we reproduce with this note will give our readers an idea of the general design, exterior appearance, and effective interior arrangement. Unfortunately they cannot represent the colour-effect which must be the first impression of any visitor. The walls and ceilings of the showrooms are

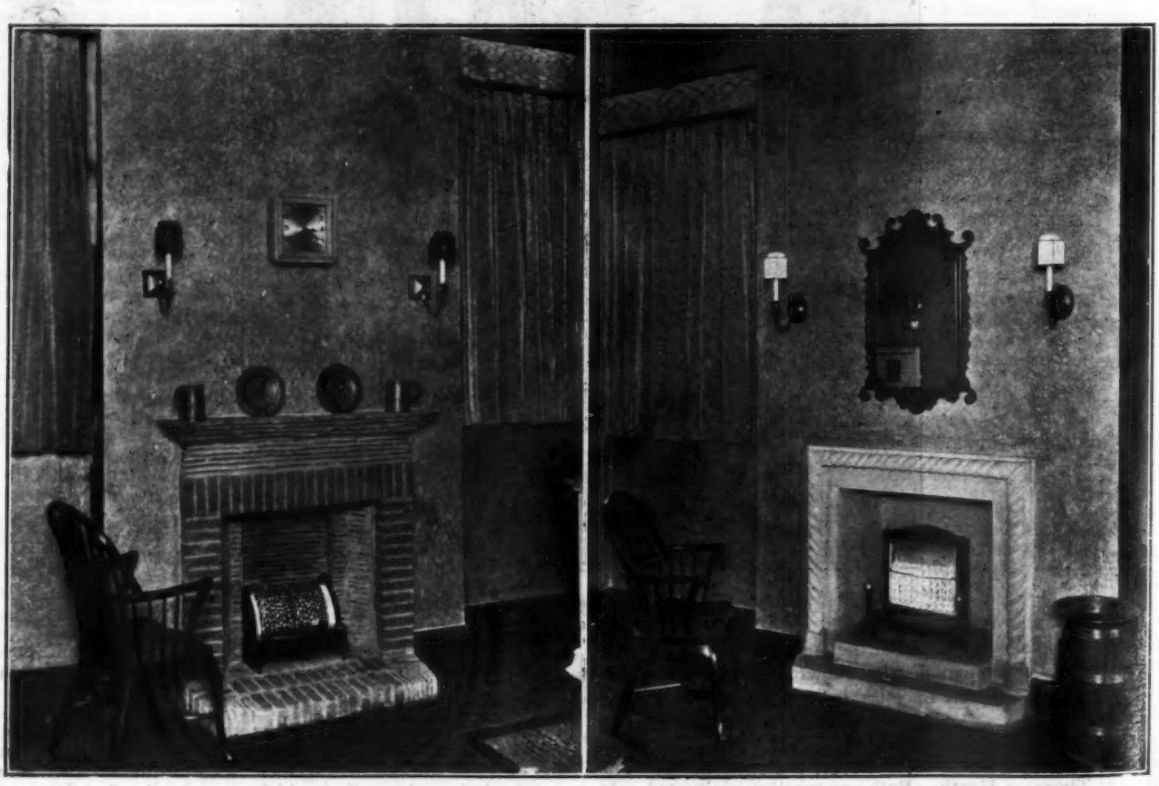
dressed in " Marb-l-cote," the scheme at Caterham being green and gold, and at Thornton Heath gold and silver. The surface of " Marb-l-cote " shows to great advantage in both premises, for, in each showroom the artificial and the natural lighting are all that can be desired, and enhance the decorative effect. Exterior lighting is efficient and plentiful; the windows are floodlighted by Sugg directive units; and the interior illumination, by Sugg " Bon Marché " and ventilating lamps enshrined in Lesofsky's drop crystals, constitutes fine lighting propaganda for the Croydon Gas Company and for the gas industry as a whole. Candle brackets with fascinating shades add the final touches to an atmosphere of quiet comfort.

A Harmonious Whole.

The Architect, Mr. A. Douglas Robinson, A.R.I.B.A., obviously envisaged the final effect when he prepared his plans. Every detail must have been considered, even to the pewter tankards (of praiseworthy size) which adorn the mantelpieces surrounding model fires. The cashiers' counters, placed so that consumers have to traverse the showrooms to pay their accounts, are in themselves works of art, with their French ironwork grilles and the singularly attractive woodwork, designed and finished to be in keeping with a highly original scheme. At Thornton Heath, French ironwork gates of Italian design are worthy of note, and at Caterham wood doors are a striking feature. Every fitting, in fact, is calculated to inspire the visitor with confidence in the gas industry, and to demonstrate in a moment that gas usage can be a combination of art and utility.

General Features.

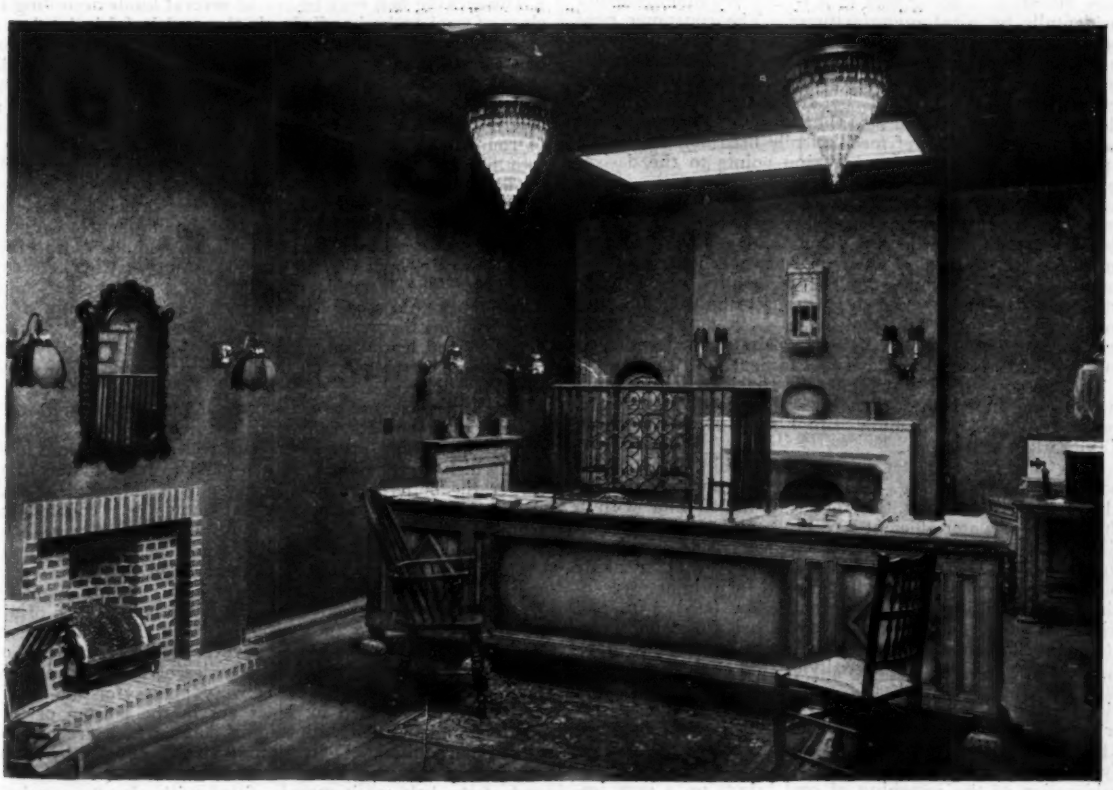
It is not our intention here to burden our readers with a



THORNTON HEATH.

specification of the various cookers, fires, and other appliances displayed; but we must remark that they are displayed extremely well. The stonework settings for the gas-ignited coke fires and for gas fires which must stir the desire for possession are unusually fine. Everywhere there are live gas points for demonstration purposes; and these demonstrations are staged so that the consumer may visualize the apparatus as he would see it if fitted in his own house—or, at any rate, as it could be fitted. Model kitchens resplendent in white tiles, and complete with enamelled gas appliances, are convincing propaganda for the cleanliness and labour-saving of gas. Various types of water heaters, fired by both gas and coke, are in operation, so that the consumer can be satisfied that their working is as good as their appearance. In one model kitchen there is live demonstration of three hot water systems. All piping to gas fires is concealed—a very important feature.

The lighting is, needless to say, switch-controlled; and the difficult problem of displaying lighting fittings has been solved very well indeed. The general impression one obtains of both showrooms is that they are nicely balanced; they are neither too opulent nor too tawdry; they appeal to all classes of consumer. In each case there is plenty of room for extension should this be desirable. We suggest that extensions may become necessary before very long, judging from what we have heard of the interest which the new premises have aroused and the business and goodwill which they have gained.



CATERHAM.

COAL HANDLING.

An Address by the Chairman of the "S.B.G.I.," Mr. Charles A. Goodall, of Leeds.

The vicissitudes of the coal industry have occupied the public mind very largely during the past few years, and it is rare indeed that one can pick up a newspaper without finding some prominent reference to our basic industry. Shortly it will again become the main topic of newspaper comment, for with the end of the year the coal marketing schemes will be the subject of Government discussion, as will the questions of wages and hours, which are due for revision at that time, with the expiring agreements.

Early Days.

The coal industry vitally affects everyone in this country either directly or indirectly, and particularly so the gas industry. And yet the coal mining industry is nearly 700 years old. Its commencement was in 1239, when a Charter was granted to the City of Newcastle by Henry III. to "dig coal;" and this was so successfully carried on that 50 years later laws were passed for its regulation. It is then nearly 500 years before we find any reference to the handling of coal by mechanical means, for it was in 1715 that the first steam pumping engine was installed in a colliery in the Newcastle coalfield; and the earliest mention of the use of screens was in 1740: "In this year the mischievous practice of screening coals was first introduced at Willington Colliery by Mr. William Brown. The screens were first made very narrow, but were a good deal enlarged towards the year 1770" (North of England Inst. of Min. Eng., 1865-6, Vol. 15, 175). The use of bar screens of the stationary type soon became general, but it was only about the middle of the 19th century that moving screens were introduced; one of the most successful of these early types being a flat suspended screen which was subjected to a bumping action. About 1890, the use of screens really developed; and since that time new mechanical methods and machinery have from time to time been brought into use for dealing with the getting and handling of coal in the pit and on the surfaces. To-day the development continues.

Sizing: The Call for Uniformity.

A great deal of attention has been given in recent years to the sizing and cleaning of coal. The percentage of small coal and dirt in coal, as drawn, is considerably greater to-day than in pre-war times; and this, to a large extent, is due to the ever-increasing use of coal cutters, face conveyors, gate end loaders, and other machinery in the underground working of the mines, and also to the working of thinner seams. The day of the pick and shovel is gradually drawing to a close, and their place is being taken by mechanical appliances.

The screening of coal has become a very important matter, and more attention is being paid to it by colliery managements and incidentally by plant manufacturers. The consumer now demands a sized and graded product. This is particularly so with anthracite coal, and also with coking coal. Another incentive is the increasing adoption of cleaning plants—both wet and dry systems—where a sized coal is imperative for efficient operation. It has been found also that a uniformly graded fuel is a factor in the efficiency of mechanically fired boilers as well as in producer plants. Thus everything points to the desirability of a sure means of uniformly sizing coal.

The advantages of clean coal cannot be too strongly emphasized; but it is only within recent times that it has been regarded other than as a luxury. Competition among colliery companies for the disposal of their produce now necessitates a reliable and non-fluctuating standard of quality, particularly when the coal has to be taken overseas or to be used for process work such as gas or coke making.

I have indicated that correct sizing is a first consideration of cleaning, so that it would be advisable to deal with this aspect first. The type of screens now generally considered good practice may be put under three headings: (1) Revolving screens (for wet or dry coal); (2) medium or high speed shaker screens; and (3) vibrating screens.

Revolving screens are generally used in washing practice, as they permit of wet screening. Wet small coal and dirt tend to clog the meshes; but with the revolving action and with a plentiful supply of water efficient screening can be obtained with material down to ¼ in. and less. Of shaker screens, two kinds are available. (*a*) The medium type, which is set at an angle varying from 10° to 15°, is usually adopted for primary screening—that is, for taking out small coal below (say) 3 in. and delivering the large coal on to the picking belt for hand cleaning. (*b*) The high-speed type, which is set from 5° to horizontal, is usually adopted for classifying the coal below 3 in. into various grades. The latter type is highly efficient for dealing with coal from 3 in. to ¾ in., by-passing below ¾ in. for further grading. Vibrating screens, of which there are two main types—mechanical and electrical—are very suitable for classifying coal of 1 in. and downwards.

Consideration of the screening of coal brings up a very important question. There is no uniformity regarding the description and meaning attached to various sizes of coal. At present, individual producers and buyers are left to make their own interpretation; whereas a standard for all concerned is the only way of obviating any misunderstanding. Let us take, for example, products which are made at different collieries, and sold as (say) 2-in. nuts. The very fact that the screens used may have a round, a square, or a diamond shaped hole, and be operated on different principles, results in the production of a grade of coal which, though purporting to be a 2-in. nut, may be slightly larger or smaller, depending on the type of mesh used.

The Fuel Research Board drew attention to this matter in their Annual Report for 1925 (page 67), in which they published the recommendations of the Federation of British Industries. "Run of mine" coal (which is coal as loaded into the tub by the hewer at the coal-face) is rarely sold at the present time, due to the demand, already mentioned, by the consumer for a clean and graded coal.

The Processing of Coal.

Thus present-day coal as received by the consumer is not the raw material that many think it is. It has to be processed; and an indication of what processes it has to pass through will not be out of place here. After being brought up the shaft in tubs, the coal is conveyed to tipplers situated in the screening plant. Incidentally, under the Coal Mines Regulation Act all new screening plants must be at a distance of not less than 80 yards from the pit shaft. This regulation necessitates the use at times of creepers and controllers along the tub track either to assist or to retard the tub in its passage.

The tipplers most commonly used now are of the side-revolving type, and are made of two rings of either cast iron or cast steel from 6 ft. to 8 ft. diameter, which are built together with mild steel plates and angles. They are fixed in the tippler house with rails running through them, so that as the full tubs travel from the pit they pass into the tipplers. These are automatic in operation, insomuch as the full tub on entering the tippler releases the empty tub which, leaving the tippler, strikes the operating mechanism and sets the apparatus in motion. It is brought to rest at the end of one revolution by being lifted off the driving rollers. During the revolution, the coal is delivered on to the screen either by chutes or jigger feeders. After the coal has passed over the screen, which is fitted with plates perforated with various sized holes, the larger coal, generally above 3 in., is delivered on to the picking belts. Here it is hand-picked by men or boys who take out the stone and the inferior coal.

The picking belt may be one of several kinds according to the class of coal to be handled. If the coal is fairly hard, a plate belt will probably be used. The plate belt is made of a series of steel trays from 3 ft. 6 in. to 6 ft. across, fixed to mild steel chains about 12 in. pitch running over sprocket wheels about 60 to 80 ft. centres. If the coal is soft and easily broken, a bar belt is found most suitable. The bar belt is made of a series of round bars similar in width to the trays, fixed at the ends into flat bars, thus forming chains along the sides, and also having two or more intermediate strands of chain. A plate belt, having solid trays, carries all the picked coal left on the belt to the railway trucks; while a bar belt, having spaces between the bars, allows any small coal and chippings made during the process of picking and cleaning to fall through on to the bottom of the belt. The latter is arranged as a conveyor to take the smalls back to a small coal conveyor, and carries the large size only to the railway trucks. At the end of the picking belt is usually fixed a lowering arm, which lowers either by hand or mechanical gearing on an incline into the truck, and thus prevents breakage.

Belt conveyors are also used as picking belts, and are made of either an endless rubber and canvas belt or other belting material, running over a series of rollers. The large lumps of coal which householders always liked to have in the past—the larger the better—are now going out of favour; and the tendency to-day is for a uniform coal known as "cobbles," which usually pass through a 5-in. hole and over a 3-in. hole and therefore do not require breaking before being put on the fire.

Coal below 3 in., after passing through the large screens, is usually conveyed to a washery or dry cleaning plant over a band or a drag link conveyor; the latter being made of a series of **U** links running in a trough which drag the coal along. There is also the push plate conveyor, which is built up of two strands of chain connected by a series of plates on edge which push the coal along. The delivery points for the two latter conveyors are formed by holes cut in the bottom of the conveyor troughs, fitted with sliding doors which are opened and closed as required. Delivery may also be effected by a chute at the end of the trough. A band conveyor can deliver over the end of the belt, or it may be fitted with ploughs consisting of

hinged arms which can be lowered on to the belt at an angle, thus enabling the coal to be delivered off the belt at any intermediate point. The band conveyor can also be fitted with what is called a throw-off carriage. This is a travelling carriage running on wheels and fitted with a chute on each side, thus enabling the coal to be delivered on either side of the conveyor and at any point.

Coal as a Gas Maker.

In the production of gas, the prime requisite is a coal suitable for carbonizing. The chemical composition and the physical condition both enter into this matter. The first is purely a matter of selection. The composition of coals varies from the anthracite at one end of the scale to the cannels at the other; and generally it may be taken that the softer the coal the greater the make of gas per ton. The gas engineer, however, has to consider also the bye-product yield and the coke. These are also dependent on the chemical composition; the bye-products, like the gas, being greater from a soft coal. The coke from the soft coals is usually more friable than that from the hard coals; but here the physical condition also enters as a factor. If two retorts are charged with the same class of coal, one receiving it as ¾ in. to ½ in. cubes while the other receives it as fine coal from ⅛ in. to 0 in., the coke from the latter will be distinctly harder and denser than that from the former, so that the actual size of the coal when charged affects the kind of coke produced.

There are other differences, of course, when using fine coal—such as the longer period of carbonization—but these are not relevant to the quality of the coke, as in this matter a certain amount of control is possible. Coals can also be sized and mixed to give satisfactory results. Another physical question is the presence of dirt in the coal. The dirt or ash in coal consists, broadly speaking, of sands, limes, or clays, all of which are practically incombustible. The whole of the incombustible material remains in the coke, so that the latter has a definitely higher ash content than the coal. It is therefore essential that the coal used shall be cleaned and be as free from dirt and ash as possible.

The cleaning of coal can be accomplished by two main systems—wet processes and dry processes.

Wet Washing.

The wet washing of coal is an old-established practice. The earliest patterns were the trough (Elliott) washer and the revolving barrel (Blackett) washer. Working on 2 in. to ⅝ in. coal, these washers reduce the dirt from 13 p.ct. to 3½ p.ct. They are not as successful with smaller sizes, and for this work many other patterns have been introduced, such as the Rheolaveur, Baum, &c.

If the raw coal is first divided into a sufficient number of sizes by screening, the separation can be rapidly effected with any type of machine; but as the range of size increases, the separation becomes increasingly difficult, and the capacity of the washer is reduced. Hence a compromise has to be made. The sizes are made as few as possible, and the reduced capacity of the washers is offset by the smaller number required. In all washers, the capacity for fine coal is much below that for larger sizes, so that the fine coal ⅛ in. to 0 in. is generally removed before washing, and, if washed at all, is treated separately in a slurry washing plant.

Dry Cleaning.

Dry cleaning processes are of recent birth; and among the first was the spiral separator. This machine is claimed to be efficient and economical for the treatment of coal from 2½ in. down to ½ in., for it has in itself no moving parts and is entirely automatic in operation. It consists essentially of three chutes with plain outer edges arranged spirally round a centre post. Another spiral of larger diameter is fitted below the three, and provided with a curb. The raw coal, which must be sized, is fed simultaneously to the three inner spirals. In sliding down, the coal gains enough speed to leap over the spiral edges into the outer spiral. The dirt with its higher friction hugs the centre post, while the intermediate materials run on the outer part of the spirals. Thus the separator delivers clean coal, intermediates, and dirt at separate points at the base.

For smaller sizes and broadly speaking for coal under 1 in., some pattern of air table may be used. These machines are supplied with air under pressure through a number of small holes in the table. The air separates the coal from the stone and dirt; and they, in turn, are delivered over a series of chutes to their respective storage hoppers, or the coal may be carried on a conveyor and delivered on to the picking belt for mixing purposes. Several different patterns of these tables are now on the market. Some have the coal sized first, while others deal with it in bulk, and size afterwards; but the present plants have a high power consumption, and the dust problem is still far from satisfactorily solved. Also the question of upkeep has still to be determined. The major problem, however, appears to be the difficulty in collecting and disposing of the dust.

The Progress of Coal Cleaning in England.

In June, 1928, there were stated to be 20 spiral separator installations at work in this country in cleaning approximately 1,500,000 tons of coal per annum, 8 pneumatic cleaning plants treating 600 tons of coal per hour, and under construction 9 further plants to treat 800 tons per hour.

As an indication of the progress made in the cleaning of coal at collieries, the following table is given which has been extracted from the 8th Annual Report of the Secretary for Mines for the year 1928.

Information available for 1928 of the extent to which coal was washed or cleaned in preparation for the market indicates a growth of the practice. The particulars show that over 60 million tons of coal were treated in this way, or 25·4 p.ct. of the total quantity of saleable coal raised. In general, the only coals suitable for washing or cleaning by these processes are the fines or smalls; and in relation to the output of these classes of coal, the proportion actually so treated is considerably higher than the percentage quoted. These figures are more comprehensive than those published last year, since they cover a number of cleaning plants at coking plants, situated elsewhere than at collieries, which were not dealt with in last year's inquiry. Of the total quantity treated, 57½ million tons passed through 525 washeries, 2¾ million tons through 53 dry cleaning plants, and a small quantity was treated by the froth flotation process operated by seven plants. In addition, there were 23 washing and cleaning plants which were not in use during the year.

The total tonnage treated at colliery plants during 1928 represented an increase of approximately 5 million tons over 1927. The districts with the largest actual tonnage treated were South Yorkshire, Scotland, South Wales and Monmouth, Durham, West Yorkshire, and Lancashire and Cheshire. These districts accounted for four-fifths of all the coal washed or cleaned in 1928, of which particulars are recorded. The proportion of output treated was relatively highest in Cumberland and Westmorland, 61·4 p.ct.; South Yorkshire, 44·8 p.ct.; West Yorkshire 33·4 p.ct.; and Lancashire and Cheshire, 25·5 p.ct.

At the Consumers' End.

When the coal has been cleaned, screened, and sized at the colliery and loaded into railway trucks, it is ready for delivery to the customers' works, when again the question of suitable handling machinery comes into consideration.

Hopper-bottom wagons, if delivering into a ground hopper, can discharge without machinery. End-tipping wagons can be discharged with hydraulic or electric tippers; ordinary wagons can be emptied in revolving tipplers; and, recently, tipplers have been introduced to discharge ordinary wagons by partly rolling them over in a side-tippler.

Another method of unloading is by means of a crane and grab, which lifts the coal from the trucks, or, if delivered by water, from the barges. Coal may also be unloaded from barges by a vertical elevator carried in a cantilever frame over the barge and lowered into the coal, which it scoops up. It is then delivered into a hopper which in turn can be fitted, if necessary, with a weighing machine and crusher from which it is discharged to an elevator or conveyor for transfer to the storage bunkers. The elevator may be the ordinary chain and bucket type, which consists of strands of chain running over sprocket wheels on which are fixed a series of buckets at the required pitch. The framework of the elevator is made of angles and plates, and is usually totally enclosed with inspection doors or removable plates in the front. At the foot are the tension blocks, which enable the chain to be adjusted. From the elevator the coal is delivered on to a conveyor of one of the types already described, and then to the bunkers. A gravity bucket elevator may be used, consisting of an endless series of large buckets, built-up in either steel or cast malleable iron, swinging between two strands of chain formed of links and rollers. These buckets run over the top of the storage bunkers, and are tipped by a mechanical arrangement whenever they are required to be discharged. These conveyors may also be used in addition for the handling of coke or ashes.

Storage of Coal.

The storing of coal is still something of a problem. Ground stacking exposes the coal to weathering, occupies a large area of ground, and also creates something of a nuisance due to dust and dirt. For quantities of coal over 2000 tons, however, it is the only practicable solution; while for less than this, steel or concrete bunkers may be used. If large coal is bought, a crusher to reduce it is necessary, and can be fitted-up below the ground hopper with provision for by-passing the smaller coal when necessary.

To take the coal from the bunkers depends, of course, on the position in which the latter are placed and the purpose for which the coal is required. If for use in gas-works, and the bunkers are placed over the retort bench, the coal is drawn through doors at the bottom of the bunkers into the machinery for charging the retorts. If for use in boiler houses, the coal may be delivered through a series of discharge doors fitted with chutes to transfer the coal to the mechanical stokers. In the latter case an intermediate measuring and recording chute can be fitted to record the amount passed through. If

Number of Coal Washing or Cleaning Plants Installed and the Quantity of Saleable Coal Washed or Cleaned in Each Colliery District of Great Britain during 1928.

(*a*) Classification according to colliery district.

District.	No. of Washing or Cleaning Plants Installed.*			Quantity of Saleable Coal Washed or Cleaned. (1000 Tons.)				
	Washeries.	Dry Cleaning.	Froth Flotation.	Washeries.	Dry Cleaning.	Froth Flotation.	Total.	P.Ct. of Total Output.†
				Tons.	Tons.	Tons.	Tons.	
England and Wales—								
1. Northumberland	16	12	..	979	533	..	1,513	11·7
2. Durham	38	8	1	5,478	1212	7	6,699	19·3
3. Cumberland and Westmorland	11	1	1	1,300	13	..	1,314	61·4
4. Lancs. and Cheshire	43	9	2	3,594	181	60	3,836	25·5
5. Yorkshire, South	55	4	..	13,696	168	..	13,865	44·8
6. Yorkshire, West	35	7	1	3,877	267	11	4,155	33·4
7. Nottinghamshire	21	..	..	2,688	..	..	2,688	20·4
8. Derbyshire, North	23	1	1	2,512	9	90	2,612	20·0
9. Derbyshire, South	1	..	..	12	..	..	12	1·4
10. Staffordshire, North	15	..	..	2,141	..	..	2,141	39·3
11. Cannock Chase	7	4	..	267	33	..	301	6·3
12. South Staffs. and Worcester	..	..	..	..	..	..	..	..
13. Leicestershire	..	1	..	..	2	..	2	0·1
14. Warwickshire	3	3	..	86	168	..	254	5·7
15. Shropshire	..	..	..	..	..	..	..	..
16. Forest of Dean	..	..	..	..	..	..	..	..
17. Somerset	..	..	..	..	..	..	..	..
18. Bristol	1	..	..	29	..	..	29	16·9
19. Kent	..	1.	..	..	92	..	92	9·9
20. South Wales and Mon.	105	2	2	7,478	48	19	7,546	17·4
21. North Wales	5	1	..	458	15	..	473	14·2
Total	379	54	8	44,602	2746	189	47,538	23·2
Scotland—								
22. Fife and Clackmannan	25	..	..	3,162	..	..	3,162	39·7
23. Lothians (Mid and East)	19	..	..	2,142	..	..	2,142	47·9
24. Lanarkshire, Linlithgow, Stirling, Renfrew, and Dumbarton	103	1	..	5,915	27	..	5,942	37·8
25. Ayrshire, Dumfries, and Argyll	19	..	..	1,540	..	..	1,540	36·9
Total	166	1	..	12,760	27	..	12,787	39·5
Great Britain	545	55	8	57,363	2773	189	60,326	25·4

(*b*) Classification according to situation of plant.

1. Plants at collieries treating coal from—								
(*a*) Collieries where plant is situated	364	49	6	34,035	2107	169	36,311	..
(*b*) Collieries belonging to owners of plant	133	6	1	16,684	666	12	17,363	..
(*c*) Collieries irrespective of ownership thereof	19	..	1	2,673	..	7	2,681	..
Total	516	55	8	53,393	2773	189	56,356	..
2. Plants at coke works	29	..	..	3,969	..	..	3,969	..
Grand Total	545	55	8	57,363	2773	189	60,326	..

* Including 23 washing and cleaning plants which were not in use during the year. There were 513 mines and 27 works at which these washing or cleaning plants were installed.

† In relation to the output of coal which is generally suitable for washing or cleaning—*i.e.*, fine or small coal—the proportion actually so treated is in general considerably higher than is indicated above by the percentage of the total output of coal washed or cleaned.

the storage hoppers are fixed on the ground, they can be emptied through a series of doors on to a conveyor.

Up to this point I have dealt with mechanical handling plant more particularly for dealing with coal; but this class of plant can, of course, be used in thousands of ways for handling all classes of material. The old-time methods of carrying, wheeling, and pushing are gone; and now there is scarcely a warehouse, factory, or workshop where by means of conveying machinery work can not be speeded up, production increased, and the workman benefited in carrying on his job. In addition, when rightly installed, conveying machinery proves a paying investment for the employer.

Our Relations.

The relationship of the gas industry to the coal industry at the present time is a peculiar one, due to the Inquiry that is taking place in connection with proposed grid schemes for the distribution of domestic and industrial gas. On the one hand we have the gas industry proper, a large customer of the colliery proprietor and reasonably jealous of its position as the supplier of gas for lighting and power, and which will no doubt fight for its position. On the other hand we have the coke-oven industry, largely under the control of the colliery companies, using every endeavour to enter the gas market, with what has always been considered its surplus product gas. A further possible source of supply of gas is the low-temperature carbonization industry, which is making, according to reports, great headway.

The situation that has to be faced is, therefore, that there are two potential sources of supply of the main product for which the gas industry has its being. The writer has every confidence, nevertheless, that by the continually increasing use of mechanical aids the gas industry can successfully compete with the two industries referred to. Gas coke properly made, properly graded, and sensibly used is comparable with any smokeless fuel and is produced at a lower price.

At this early stage it would be difficult to prophesy the outcome; but it does appear that an unprejudiced survey should prevail in order that the best use may be made of our resources. If by closer co-operation the coal industry and the gas industry can make greater use of our own natural and internally won products to the disadvantage of imported products, no stone should be left unturned to produce the result.

The trend of events will be most interesting to follow.

Discussion.

A Co-Operative Buying Organization?

Sir Arthur Duckham said they were indebted to the Chairman for a most interesting and opportune address. At the present time they were going through a new phase in the coal industry. It was a phase of co-operative selling of coal—co-operative selling which had had its inception in years of bad trade in the coal industry, and in realization that the low prices of coal were due to competition within the industry, rather than from foreign countries. The various areas were developing their own selling organizations. The corollary of the selling organization must be a buying organization, and he was certain that the coming years would witness co-operative buying on the part of the big industries who used fuel. Now, co-operative buying must mean a better specification to be fulfilled. In the past there had been buying of spot lots of coal; and there were many gas and other industrial engineers who had suffered through those responsible for the purchase of coal buying unsatisfactory coal at a low price. These days were passing, and days of co-operative buying would take their place. Such methods must involve dealing in bigger lots, and they would certainly mean the more efficient purchase and use of coal. Nothing but good could come from such a discussion as this address should give rise to.

Cleaning of Coal.

The cleaning of coal was a subject of which he (Sir Arthur) could speak with knowledge, because some years ago the firm with which

he was connected interested themselves in this subject, and found that the great problem of coal cleaning and the wet washery was the moisture in the resultant smalls. One plan had been to take out the fines before washing. When they came to dry cleaning, the whole problem was dust, and this still required a certain amount of consideration. But undoubtedly dry cleaning in certain processes was giving increasingly important results. He did think that the dust problem was being held. In the system with which he was connected they had taken steps to overcome this difficulty. One thing they had found was that if there was fog in the cleaning house, one got very little coal dust. The moisture in the fog collected on the dust, and the cleaning house was a better place. Therefore it occurred to them that it might be a good thing to cause a fog all the time in this chamber. They should help each other to solve the various problems by which they were faced.

Mr. R. B. HODGSON expressed the indebtedness of the members to Mr. Goodall for having brought before them in so practical a manner the important subject of coal handling. Certainly no one was more capable of doing it. If they would cast their minds back thirty or forty years, they would remember that in those days coal was handled in a very promiscuous sort of way. There were practically no means of mechanical handling, cleaning, or screening. To-day, however, at any modern colliery, with up-to-date management, they found installed machinery which was delivering coal almost as perfectly as it was possible to do it. For a long time it was a question of delivering the coal with a good deal of moisture, due to wet washing; but now, he understood, there had been developments which enabled the coal to be cleaned and delivered in as good a condition as possible. These things showed that there was a desire to get down to the very best principles for dealing with coal. He felt sure the same applied to everything pertaining to the efficiency of industry. Remembering how things were at the earlier date to which he had referred, it seemed remarkable that there were now in this country nearly 600 washeries. Indeed, so much was being done that the time could not be far distant when fuel would be delivered to them with the utmost economy.

THE DIFFERENT CIRCUMSTANCES OF YEARS AGO.

Mr. COMLEY remarked that the address focussed attention on what had been done and was being done by the coal industry in the discharge of their obligations towards their customers. One might suppose, on reading all that had been written and hearing all that had been said as to the lack of enterprise on the part of the coal industry, that they were unmindful of what they owed the consumer; but here was striking evidence of the vast amount of time and money that had been devoted to the problem of preparing coal as it should be prepared to meet the multifarious requirements. It might be supposed that the unhappy users of coal from 700 years ago down to 1890 had been obliged to take such uncleaned material as the collieries saw fit to force upon them. This, however, was not by any means the case; and if coal was not so adequately cleaned then as now, neither was it necessary that it should be, because of the very different conditions under which the coal was produced. Coal was then so plentiful and so low in value that only the best of it saw the surface; and if a miner by any chance sent to the top a ton of coal that was not reasonably clean, he was very soon wanting another job. Thus the necessity for elaborate machinery did not exist. The great bulk of the output was large coal; for the small there was no market. In those days best large hand-picked coal would probably be selling for 7s. or 8s. per ton, and the buyer who did not receive 22 cwt. to the ton would return the invoice. All this would enable them to understand why coal was not cleaned in those days. Turning to the table accompanying the address, it would be seen that no less than 60 million tons, or one-quarter of the total output, was washed or dry cleaned last year; and when it was remembered that only the smaller—from perhaps 3-in. down—was so treated, it would be realized that the percentage of this coal requiring treatment was very high. This afforded the best answer to those people who seemed to take a delight in vilifying those who were engaged in the coal trade.

EXPERIENCE TEACHES.

Mr. R. J. MILBOURNE said that the coal troubles of recent years had brought home very forcibly to every gas engineer the absolute necessity of safeguarding and maintaining a continuous supply of gas to the consumer, which might be endangered through interruption of the coal supply. There was only one way by which this safeguarding could be secured, and that was by storing at the gas-works an adequate quantity of coal—say, from ten to twelve weeks' supply. When it was remembered that the gas industry's requirements were about 18 million tons of coal per annum for carbonizing, it would be seen how important it was that gas engineers should consider the most suitable and expeditious methods of handling such a huge amount of material—more especially as forces were now at work in the coal industry which might eventuate in a critical situation before many weeks had passed. There was every indication that the new marketing scheme would result in an addition to the cost of coal. Then there was the miners' compensation scheme. This would cost the country several million pounds per annum, which would have to be met by the home buyer and the British taxpayer. There was further the uncertainty as to the extent to which working costs, and consequently the price of coal, would be increased by probable change of hours and wages which would have to be paid to the miners. For all these reasons, it was imperative that the gas industry should adopt the most economical methods of dealing with the mass of coal which it had to handle; and it was very important that the coal which was supplied should be clean and suitable for the purpose for which it was intended. Coal bought in a haphazard manner, with price as the only factor considered, would undoubtedly cause much inefficiency. Therefore, the careful selection and estimation of the value of the coal was a matter of supreme importance.

It would be seen from the details given in the address regarding the various undertakings which had adopted either the wet or the dry process of cleaning, that there was still much to be done by the colliery proprietors in sending out the article required.

ASH CONTENT OF COAL AND COKE.

Mr. J. WILFRID DRAKE said they had heard a good deal on the subject of coal, but they had not heard much regarding the relationship of the coal to the resultant coke. The Chairman said that the whole of the incombustible material remained in the coke, so that the latter had a definitely higher ash content than the coal. Now, he was going to ask whether this statement was correct, because, from experiments which had been carried out promiscuously over a certain length of time, he had reason to believe that, with the process of carbonization, there was an action taking place whereby a certain amount of the ash was separated out, and was not contained in the finished coke. If the Chairman's statement was correct, one would expect, with a coal containing (say) 10 p.ct. of ash—that was, 224 lbs.—to find this in the resultant 14 cwt. of coke, after carbonizing; but there were many instances in which the amount of ash contained in the coke had been definitely lower than the quantity contained in the original coal. It would seem, therefore, as though there was something in the process of carbonization whereby ash was separated. Towards the end of his address, the Chairman said that gas coke properly made, properly graded, and sensibly used was comparable with any smokeless fuel, and was produced at a lower price. He might have gone further, and said it was not only comparable with, but in many instances it was definitely superior to, any smokeless fuel, in so far as it contained less ash, it ignited much more easily, and it gave a better result in the fire.

WORK OF THE DISTRIBUTORS.

Mr. W. J. D. HOWELL said there was one point in connection with which a little correction should be made. The Chairman said "run-of-mine" coal (which was coal as loaded into the tub by the hewer at the coal-face) was rarely sold at the present time. As a matter of fact, there was a very large tonnage to-day. Most of the Durham coal sold now was sold as Durham unscreened coal. There were also very large tonnages of Welsh through-and-through coal shipped. He was sorry to hear Sir Arthur Duckham's prognostication that possibly there would be co-operative buying, because, as a member of one of the largest firms of coal distributors, it looked to him (the speaker) as though he might shortly be out of a job. His firm supplied something like 300 gas-works; and they maintained that they had justified their existence, otherwise they would not be in business to-day. They had done this not only by specialized efforts to secure the particular coal required by gas managers, but also by investing many hundreds of thousands of pounds in providing rolling stock not forthcoming elsewhere, and by extending credit to the gas companies, which was a not unimportant point. Mr. Milbourne had made reference to the 1926 strike. His firm certainly justified themselves then by saving the industry through the importation of foreign coal. It was a very near thing indeed. Had the strike not succumbed when it did, the position would have been very serious. As to the coal marketing schemes, he hoped that when they were finally put into shape they would prove to be sufficiently elastic, and the coal would be there when it was required. If the whole of the coal trade of the country was going to be dealt with under these schemes, in the interest of the consumer they should be made elastic enough to meet the demand.

MINIMIZE BREAKAGE.

Mr. G. J. JACKSON said there was one point in connection with coal handling which had not been referred to, but which he thought had a very important bearing, not only on the producing end, but at the receiving end. This was the lay-out of the plant which had to handle the coal. It was possible in old works to see handling plant which involved the dropping of the coal a considerable distance. This resulted in breakage and dust; and he thought if people, when they were installing plant, would give more consideration to the lay-out, so that the machinery would carry the material without breaking it, they would get better and more saleable coal.

Mr. FRANK WEST proposed a hearty vote of thanks to Mr. Goodall for his address; and this was seconded by Mr. MILBOURNE, and heartily carried.

The CHAIRMAN, after acknowledging the vote, said the question of coal was certainly a very important one; but the points raised did not need an extended reply from him. Dry cleaning was a baby of more recent birth, and they would look for still further improvements in this direction. The point which had been raised by Sir Arthur Duckham, in connection with dust, had to be overcome, exactly as the question of the moisture in wet cleaning had to be in its early days. The idea that fog would have a tendency to keep down the dust seemed a sound one; and if they could do that, and keep their joints tight, he thought they would go forward, and be able to have coal which was properly cleaned and properly sized, and ready for sale to suit varied requirements. It was what had happened in the old days that they were suffering from now. Then they went for the good stuff. To-day it was necessary to work the thinner seams, and deal with coal which had a greater ash content, and had to be dried and cleaned; and consequently the manufacturers had come along with the necessary machinery. As to Mr. Drake's query, he (the Chairman) was not a technical man; but he was certain that Dr. E. W. Smith would be only too pleased to give full information on this subject. In the address, he had merely made a broad statement, and in this he fancied he was not far wrong. In the matter of the breakage of coal, he was with Mr. Jackson. They did find that, after coal had been sized and cleaned, and taken every care of, it was frequently knocked about, and consequently all the nice sizing which had taken place was interfered with. It was advisable, if possible, to deliver the coal on to a spiral chute, or something of that kind, so that it would be gently carried along.

COMPLETE GASIFICATION PLANT AT MILL HILL.

By F J. Pearce, of the North Middlesex Gas Company.

[Paper before the Southern Association of Gas Engineers and Managers, Nov. 22]

The complete gasification of coal in a single unit of plant is an ideal which has been aimed at by a goodly number of engineers and chemists for many years, whose efforts have been attended by varying degrees of success. In coming before you with a contribution on this interesting subject, it is not my intention to attempt to offer any criticism or comment on what others have done towards attaining this object, but to place before you some particulars of a plant which has been installed at the works of the Company I have the honour to serve, and which has been, and is, successfully completely gasifying coal and at the same time working 24 hours per day and seven days per week.

Early in the year 1925, Messrs. Humphreys & Glasgow, Ltd. (who are so well known as manufacturers of carburetted water gas plants), approached my Company with a request that they might be allowed to carry out some experiments on the complete gasification process at Mill Hill. These experiments would involve certain alterations to the generator and gas connections of the set to be placed at their disposal, and permission was granted to them, subject to the proviso that their alterations should in no way impair the use of the plant as an ordinary carburetted water gas unit. This guarantee having been given, No. 1 plant was put at their disposal for the necessary alterations to be carried out.

These alterations consisted principally of superimposing on the generator a carbonizing chamber (into which coal would be fed by suitable means, and where it would be carbonized), the introduction of an additional washer between the carbonizing chamber and the main gas off-take from the superheater, and an electrically-driven fan for circulating hot gas through the plant and carbonizing chamber, together with the necessary connections.

Fig. 1 is a general illustration of the plant before any alterations were made, and is doubtless familiar to all as an ordinary carburetted water gas plant.

Fig. 2 shows the plant after the necessary alterations had been carried out. A is the generator, with the carbonizing chamber B superimposed on it. The enlarged portion in the centre, between A and B, is the blast annulus in which the blast gases collect on their way to the carburettor C during blowing operations, these gases not passing into the carbonizing chamber B. D is the superheater, and remains unaltered. E is the additional or back-run washer on the gas off-take pipe from the carbonizing chamber B, and connects directly with the gas off-take pipe from the superheater. F is the main washer and G the circulating fan, by means of which a proportion of the gas made during the back run is drawn off and circulated, together with the back-run steam, through the set, including the carbonizing chamber B. The gas made during this operation leaves the generator by the off-take pipe from the top of B. This gas passes through the back-run washer E (which is virtually equivalent to a hydraulic main), and from here to the off-take pipe leading into the main washer F.

As a matter of fact, both these washers function as hydraulic mains, there being a considerable deposition of heavy tar in each. The question may arise as to what happens to any gas evolved in the carbonizing chamber during the other part of the run and while "blowing." A certain amount of coal gas is, of course, being produced here all the time. This leaves by the off-take pipe at the top of the chamber, enters the back-run washer E through the seal, and is led off to the main washer F through a small pipe H. On this pipe is a hand-controlled valve which has to be carefully regulated, and the setting of this valve can be checked from time to time by the simple expedient of lighting a gas flame led off from the main off-take pipe from B during the "blow." If the flame is very poor it indicates that the valve is open too wide, while, if a rich gas flame is obtained, the opposite is the case.

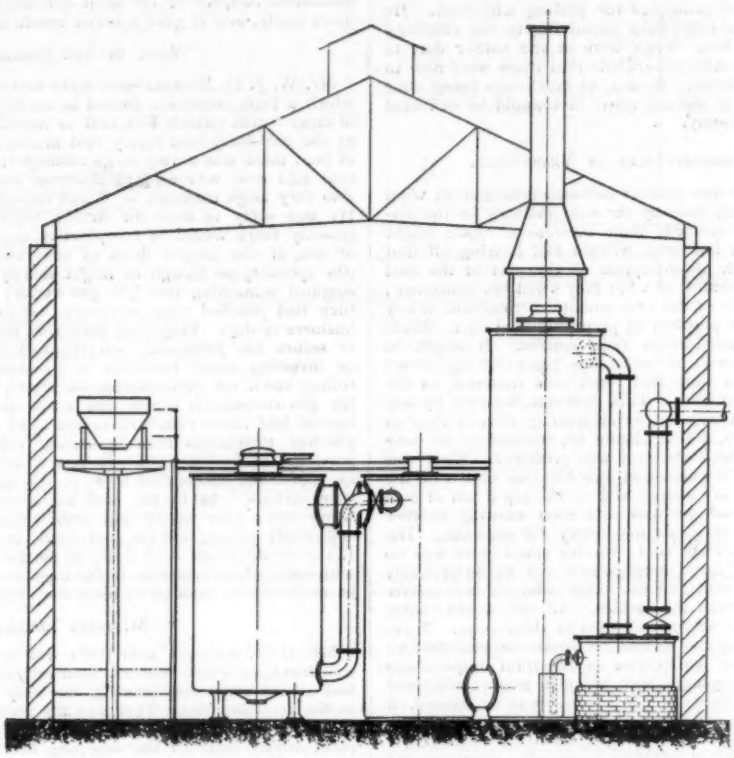


FIG. 1.

Operation of the Plant.

The operation of the plant is very similar to that of an ordinary carburetted water gas plant fitted with back run, with the exception that a portion of the run is still retained as a down-run.

The travel of the gases through the plant will best be illustrated by drawing your attention to fig. 3. This has been prepared diagrammatically in order to show as clearly as possible the direction of the flow of gases during the various periods of the gas-making run and blowing operations. In the top left-hand corner is the key to the diagram.

The blasting operation is exactly similar to ordinary C.W.G. practice. The gas-making run is divided into three portions, consisting of "down run," "back run" and "up run," the proportions of "down" and "back" to "up run" being varied according to the fuel used and working temperatures obtained.

At the commencement of the run the hot gas valve is closed

and the down-run valve opened, the steam being at the same time admitted at D, R, and passing downwards through the fuel bed as indicated on the diagram. At the end of the down-run period the back-run valve is opened. The operation of the

these two vessels to the generator, and the hot water gas produced here passes through the carbonizing chamber and away by the top off-take pipe, together with coal gas produced in the latter chamber.

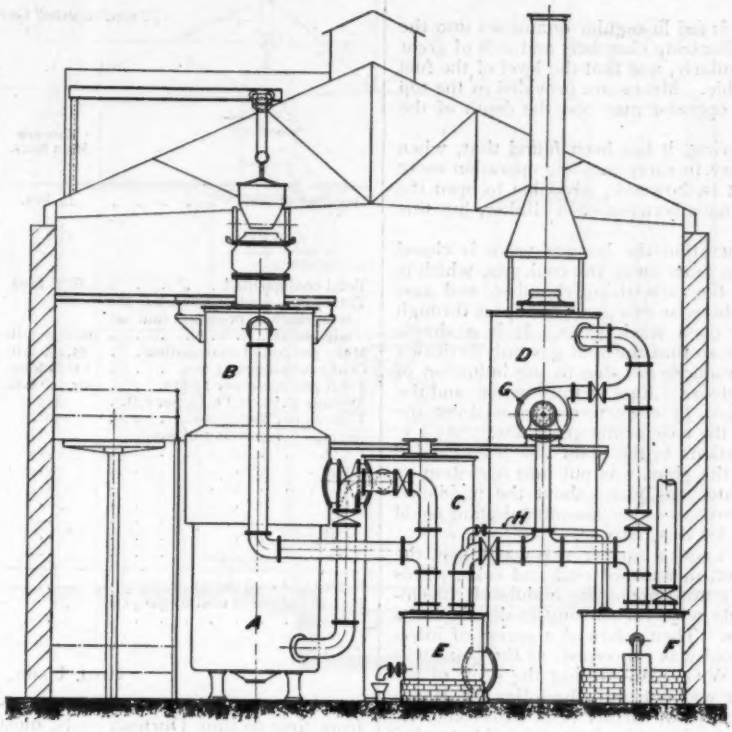


FIG. 2.

valve turns on the back-run steam at B, R, cuts off the down-run steam, and at the same time operates the butterfly valves in the gas off-take pipe and fan outlet. The actual travel of the gases will be most easily followed by reference again to the

Great attention has to be paid to the maintenance of the proper temperature of the gas leaving the carbonizing chamber; and a pyrometer is provided for the purpose of indicating this temperature, which is dependent very largely on the speed of

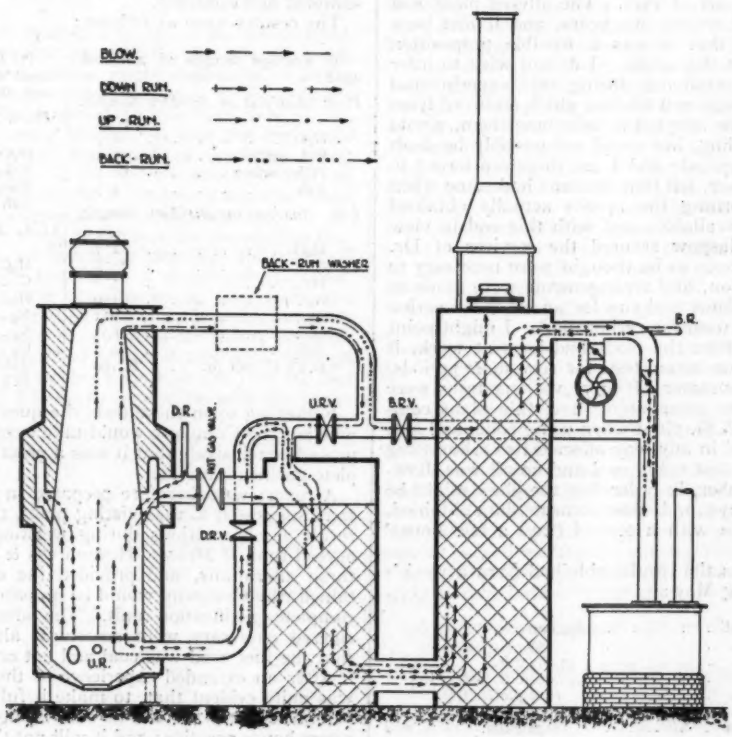


FIG. 3.

diagram; and it should be noted that a portion of the gas produced during the back run is circulated by the fan, with the back-run steam, which in its passage through superheater and carburettor becomes superheated to a very considerable degree. This results in the transfer of a large amount of heat from

the circulating fan, together with the temperature of the superheater. Careful regulation of both these is of vital importance.

On the up-run, the up-run valve is opened and the down and back-run valves closed. The steam now enters at the base of the generator, and the gas produced again passes right through

the carbonizing chamber, leaving by the top off-take, but this time traverses the carburettor and superheater in the ordinary way. At the end of the gas-making period the hot gas valve is opened and the blowing period carried on. Carburation of oil is carried out during the down and up run periods as may be required.

The coal to be carbonized is fed in regular quantities into the charger at the top of the carbonizing chamber, and it is of great importance that it be fed regularly, and that the level of the fuel be kept as constant as possible. Means are provided in the top of the chamber so that the operator may test the depth of the fuel bed from time to time.

With regard to the clinkering, it has been found that, when using coal, it is not necessary to carry out this operation more frequently than 12 hours; it is, however, advisable to open the doors and prick up the fire once between each clinker, but this only takes a few moments.

During the clinkering operation the hot-gas valve is closed and a steam injector used to draw away the coal gas, which is constantly being evolved in the carbonizing chamber, and pass it on to the main washer; otherwise this gas would pass through the set and be lost at the open stack valve. It is a simple matter to adjust the injector so that the coal gas only is drawn away without dilution of producer gas due to the induction of air through the clinkering doors. Fuel is thus saved, and the comfort of the men engaged in clinkering improved by the reduction of temperature at the base of the generator.

After the necessary alterations to the plant had been carried out, heats were raised and the plant was put into operation as an ordinary carburetted water gas plant about the middle of July, 1925, and it was demonstrated that the altered plant could instantly be made available for this purpose.

Following about a month's run, a further step was taken, the plant being run on a 50 p.ct. mixture of coal and coke. This was continued intermittently until about the middle of November, when a start was made with carbonizing coal only for a period of about three weeks. Then followed a period of intermittent working as far as coal was concerned, as the plant was required as an ordinary C.W.G. plant during the peak of the winter load, 1925-26; and it was not until the following March that it became possible to carry out further tests with coal. As by then the load had eased considerably, it was possible to continue during March, April, May, and June with the complete gasification of coal, until early in July the plant was shut down for the usual re-lining repairs.

A Successful Unit.

When the plant was re-started it was run with coal or coke as required by the Company's operators until the end of the year and also during the early part of 1927. The altered plant had now been in operation for nearly two years, and it had been successfully demonstrated that it was a feasible proposition completely to gasify coal in that plant. I do not wish to infer that no troubles were encountered during this experimental stage. The story of the snags and hitches which occurred from time to time, and the means adopted to overcome them, would make very interesting reading, but could not possibly be dealt with in the time at my disposal; and I am therefore forced to leave them. It was, however, felt that the time had come when some accurate data concerning the results actually obtained from the plant should be available; and with this end in view Messrs. Humphreys & Glasgow secured the services of Dr. Colman to carry out such tests as he thought were necessary to give the required information, and arrangements were made so that the plant could be isolated and run for an extended period on coal alone, no oil being used for carburation. I might point out here that, during the time the plant had been at work, it had only been possible to run actual tests for very short periods.

Therefore, during the summer of 1927, various tests were carried out with a view to ascertaining how this plant compared with an ordinary C.W.G. plant when using coke, and also whether the alterations had in any way affected its carburetting efficiency. The prolonged test using coal and no oil was, however, deferred until September, in order that the plant might be isolated for a number of days, and some accurate data obtained, which would be impossible with a test of (say) a few hours' duration.

The following table gives the results obtained from a week's isolated run on coke during May:

Total gas made, corrected	5,894,000 c.ft.
Total hours at work	150
Gas made per hour	39,293 c.ft.
Equivalent to	943,032 c.ft. per 24 hrs.
Clinkering time	11·9 p.ct.
Oil used, total	10,507 galls.
Oil used per 1000 c.ft.	1·78 galls.
Coke used, total generator	1,701,000 lbs.
Coke used per 1000 c.ft.	28·86 lbs.

This, I think, is sufficient to show that the plant was fully up to its work as a water gas unit; and I may say that the above results were obtained with the ordinary working of the plant by the Company's operators.

With regard to the official tests carried out by Dr. Colman, special arrangements were made so that the plant could be handed over to him for a number of days during which coal only would be used and no oil. The results obtained are given in the following table:

Tests Made by Dr. Colman.

[Uncarburetted Gas.]

—	1. Manvers Main Nuts.	2. S. Yorks Nuts from *Stock* with 9 Tons of Thorncliff Nuts.	2. Fresh Thorncliff Nuts.
Duration of test	12 hrs.	72 hrs.	Period during 72 hrs.' test when Thorncliff nuts were used
Total coal gasified	6·38 tons	39·60 tons	9 tons
Total gas made, corrected for temperature, pressure, and air admission	351,850 c.ft.	2,043,850c.ft.	..
Make per ton of coal gasified	55,150 c.ft.	51,610 c.ft.	52,630 c.ft.
Coal gasified per 24 hrs.	12·76 tons	13·20 tons	..
Total gas made per 24 hrs.	703,700 c.ft.	681,280 c.ft.	..
Average C.V., B.Th.U. per c.ft.	345	334	342
Therms per ton of coal	190·2	172·1	180
Average composition of gas—			Approx. comp.
CO_2	..	5·2	4·8
O_2	..	0·3	0·2
Ill.	..	0·5	0·6
CO	..	31·8	32·1
H_2	..	49·2	49·2
CH_4	..	5·0	5·2
N_2	..	8·0	7·6
B.Th.U. of coal in gas produced	..	54·5	57·0
P.ct. of carbon of coal in gas produced	..	41·2	43·0

Coal Used.

All coals used on these tests were South Yorkshire nuts, but from time to time Durham coals, mostly fines, have been used. It was, however, impossible to isolate the plant for test purposes while on Durham coal; and all that can be said to date is that these more difficult coals were apparently handled successfully, so far as their gasification was concerned. On several days when it was possible to measure the gas made it was found, however, that the set capacity was not so high as with the South Yorks. nuts coals.

On the 72 hours' test made by Dr. Colman all coal was sampled and analyzed.

The results were as follows:

(1) Average sample of all coal used:

Prox. Analysis on Air-Dry Sample.

	P.Ct.
H_2O	1·7
Vol. matter	33·3
Free carbon	60·5
Ash	4·5

Ult. Analysis on Air-Dry Sample.

	P.Ct.
H_2O	1·7
C	78·8
H_2	5·0
N_2	1·6
S_2	2·1
O_2	6·3
Ash	4·5
B.Th.U. per lb.	14,100

(2) For the fresh Thorncliff Nuts used during a part of this 72-hour test, the results were as follows:

Prox. Analysis on Air-Dry Sample.

	P.Ct.
H_2O	1·9
Vol. matter	34·3
Free carbon	59·0
Ash	4·8

Ult. Analysis on Air-Dry Sample.

	P.Ct.
H_2O	1·9
C	78·3
H_2	5·1
N_2	1·6
S_2	1·9
O_2	6·4
Ash	4·8
B.Th.U. per lb.	14,100

Following upon these tests the question naturally arose as to whether the Company would take over the plant, it having been proved conclusively that it was a practical proposition as a complete gasification unit.

A report was therefore prepared in which several alterations were suggested to the existing plant, these alterations being the result of observations during working; and it was ultimately agreed that, if Messrs. Humphreys & Glasgow would carry out these alterations, and provided the expected results were obtained, the Company would be prepared to retain the plant as a complete gasification unit. The alterations which were considered necessary were structural alterations due to the fact that the fuel used was coal and not coke.

After an extended experience of the working of the plant, it was quite evident that, to make it fully successful, it had to be recognized that the use of coal brought it more into line with retort house practice; and it will not therefore be out of place to enumerate the suggested alterations. I will now refer you to fig. 4, which illustrates the altered plant.

In Fig. 2 it will have been noted that the gas off-take from the carbonizing chamber B was situated at the side. This was not by any means a satisfactory arrangement, first because, if the fuel level in B was allowed to become too high through over charging, coal found its way into the off-take pipe; secondly, there was a tendency for fine coal to be carried over into the

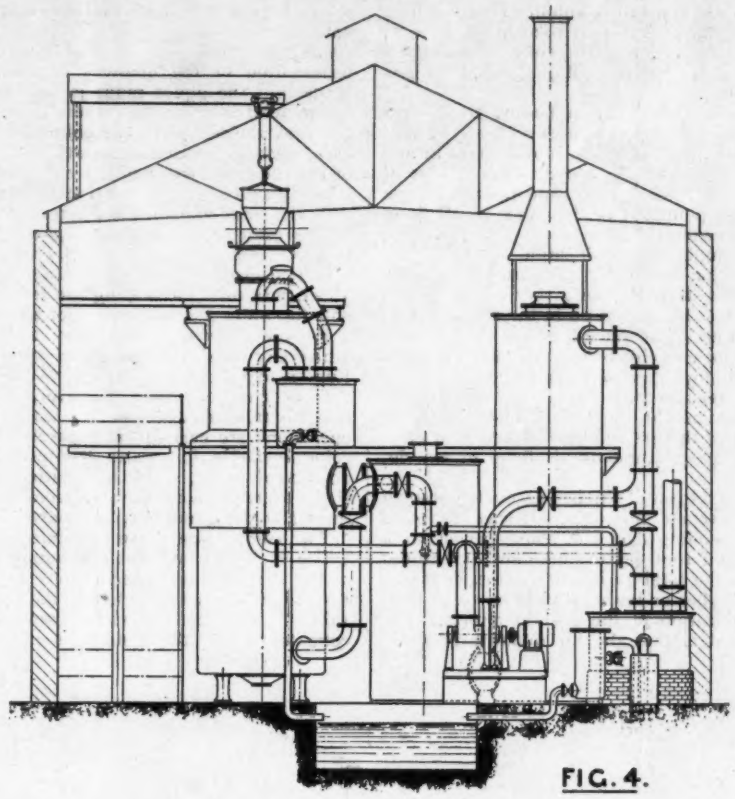


FIG. 4.

back-run washer when circulating. This was to be altered as shown in the illustration, to come off the top of the carbonizing chamber and have a cleaning door similar to an ordinary bridge pipe between the ascension pipe and the hydraulic main.

The next proposed alteration was to the back-run washer, which was situated on the ground floor, a position which rendered the removal of the tar somewhat difficult. It was suggested that this should be placed on the operating floor, so that the tar could be easily run away by gravity, and a sloping bottom provided.

The main washer next claimed attention. As constructed, for ordinary carburetted water gas practice it was obviously unsuitable for use with coal, owing to the deposition of heavy tar which it was impossible to remove by means of the ordinary overflow and seal pot. The proposal, in this case, was to provide the washer with a sloping bottom, so that the tar would drain towards a bottom outlet leading to a small tar tower which, by the manipulation of the valves, could be run off periodically. In the case of both these washers it must be borne in mind that they were functioning as hydraulic mains.

The weakest spot of the whole plant was the circulating fan. This was of a type with an overhung impeller, the shaft of which ran in ball bearings housed in a water-cooled jacket. Unfortunately, however, it was possible for tar to get into the ball bearings, with the result that they only lasted a week or two at most. It was proposed to substitute for this a fan with two outside bearings, the shaft of which would pass through glands in the fan casing. It is also very desirable that the fan should be in duplicate, but this was not possible with the set in question.

All these alterations were carried out by Messrs. Humphreys & Glasgow, and the plant was again ready for work at the beginning of January last.

It will be most instructive as to the results of the alterations to give a table of the number of days worked and coal carbonized during the January to June half-year. Plant started on Jan. 3:

—	Days Worked.	Coal Carbonized.		
		Tons.		Tons per Day.
January	22	216	=	9·82
February	26·5	269	=	10·15
March	25	249	=	9·96
April	26	276	=	10·26
May	29	309	=	10·65
June	25	275	=	11·00
	153·5	1594	=	10·38

These figures should be sufficient to prove that the alterations were justified and the plant could be considered as thoroughly reliable. In fact, during the whole of the anxious time in February and March last it worked without a hitch. It is not possible to give working results for this period, as one or more C.W.G. sets were working with this plant and the gas made mixed.

NEW PLANT.

The new complete gasification plant which has just been installed is substantially the same as the one described in this paper, except that there are two circulating fans, and a coal-handling plant has been installed for the purpose of feeding the new and also the old plant, which should mean a reduction in labour charges. The new plant is illustrated in fig. 5.

The capacity of the plant is 700,000 to 750,000 c.ft. per day when using coal and without oil, dependent on the quality of the coal. Up to the present it has required three men per shift to operate, due to the fact that all the coal has had to be shovelled into bogies in the yard, the bogies sent to the operating floor on the hydraulic lift, hoisted to the top of the carbonizing chamber by an electric hoist, and then fed into the charger by hand. On the new plant the labour will be cut down, only two men per shift being necessary. As far as I can see, there is no reason why very much larger units should not be operated by the same number of men—in fact, in the case of an automatic plant, even by less.

Up to the present there are, I believe, no other plants of this description in this country; but during 1927 and 1928 Mr. Griggs, of Messrs. Humphreys & Glasgow, who had charge of the experiments at Mill Hill, went to America, and successfully worked a plant in which the valves were hydraulically operated, and of a capacity of 1¾ to 2 million c.ft. per day, and which, with the installation of an overhead coal hopper and feed, would be operated by two men per shift.

We now come to the comparison of results of the total gasification plant and the total gasification of coal by separate processes. In his report on the working of the plant, Dr. Colman has summed up the situation very fairly, and the following extract is well worthy of consideration:

A total gasification plant such as the one under test represents a combination in one plant of means for—

(*a*) carbonizing the coal with production of coal gas, tar, and coke; and

(*b*) converting the whole of the coke produced directly into water gas.

For a corresponding total gasification of coal in separate processes there are required—

(*a*) a separate retorting plant;

(*b*) a separate water gas plant; and

(*c*) means for removing the coke made from the retort house to the water gas plant.

To get a comparison of the results obtained by the two

methods, it is necessary to ascertain the combined results which could be obtained from similar coal to that used in the present test, if first carbonized in retorts, and the coke subsequently converted into blue water gas, and the coal gas and water gas produced then mixed together.

Other factors come in for consideration besides the above, which cannot be determined from these figures with any exactitude, but which have eventually to be taken into account in any comparison made. Such, for example, are the capital cost of the plant and operating costs in each case; and though I have no detailed figures on these points, it is clear that in all these points there is a strong presumption that these values will be considerably lower for the single total gasification plant than for the two separate carbonization and water gas plants. In addition the former plant can be started up in a very much shorter time than a bed of retorts can be started up in the retort house, and can " stand-by " for a period at much less cost than these.

The total gasification plant can also be used equally well as a blue water gas plant by employing coke instead of coal, so that total gasification gas or water gas can be made according to the conditions of the coke demand at the time. The plant also permits of the enrichment of the gas made, whether total gasification gas or blue water gas, by means of oil up to any desired calorific power.

In addition there is the question of the bye-products obtained in the two ways—namely, tar and ammonia. It was not found practicable in any test extending over the above period on a plant normally in use for different gas to make any determination of the tar produced in the total gasification plant, or to say definitely whether this is higher or lower in yield or value than that obtained from carbonization of the coal in retorts. The provisional estimate formed is that the tar quantity is somewhere between the wide limits of 8 and 14 gallons, and that its value per gallon is distinctly lower than tar from horizontal retorts; but this estimate is only a very tentative one. No determination of the quantity of ammonia produced could be made, but the liquor made is so dilute that it would have no commercial value at the present time.

In calculating the results obtainable from the same coal when carbonized in horizontal retorts and the subsequent conversion of the coke into water gas, I have taken the figures for carbonization results from my own tests of S. Yorks. coal with practically the same moisture and ash content, with high temperature in the retorts, which gave 13,900 c.ft. of gas per ton of 505 B.Th.U., equal to 7,019,500 B.Th.U. per ton. The coke yield was 13·6 cwt. of dry coke containing 7 p.ct. of ash, of which 3 cwt. was used for heating the retorts, leaving 10·6 cwt. available for water gas production, of which 1·6 cwt. was breeze.

For the water gas production, the figures found in the Leeds University tests at Birmingham were taken. (Trans. Inst. Gas Eng. 1920-21, p. 322.)

Some question arises, however, as to the proper amount of coke to take as available for water gas production when the operations are carried out separately. The above 10·6 cwt. of coke *available* for water gas production contains a certain amount of breeze, and it is a matter of common experience that, if the breeze is not separated from the coke before putting into the water gas generator, decidedly inferior results are obtained.

Two comparisons have therefore been prepared, in the first of which the most favourable assumption is made that the whole of the 10·6 cwt. is converted into water gas on the basis of the Leeds University test, while in the second it is assumed that the 1·6 cwt. of breeze is previously separated and only the 9 cwt. of coke treated in the water gas plant. In the latter case, of

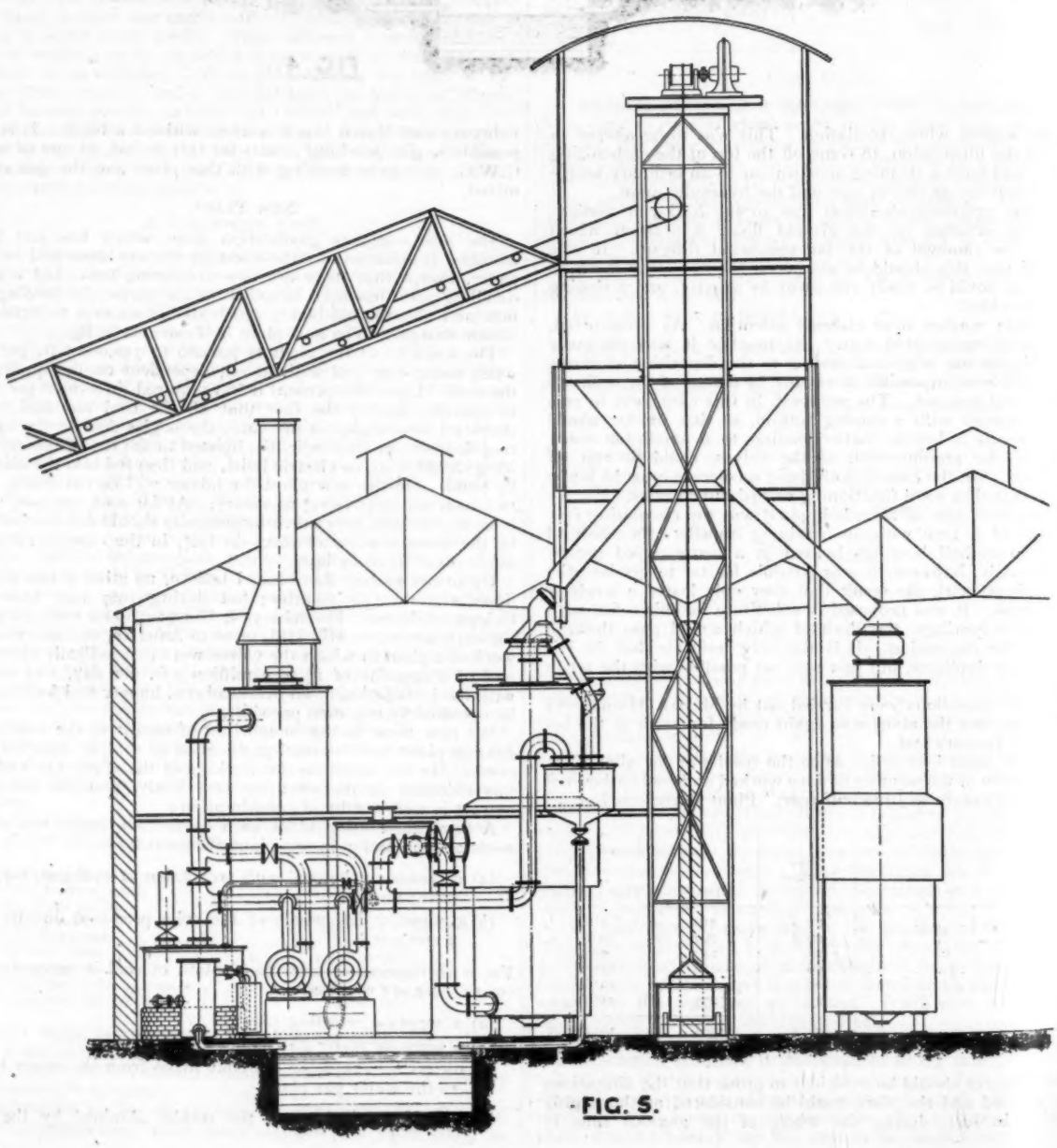


FIG. 5.

course, credit has also to be given in the double process figures for the value of the 1·6 cwt. of breeze.

FIRST COMPARISON.

The whole of the 10·6 cwt. assumed to be converted into blue water gas in accordance with the above B.W.G. test.

—	Total Gasification Results.	Separate Carbonization and Water Gas Production.
Gas made per ton	51,610 c.ft.	45,350 c.ft.
Calorific value, gross	334 B.Th.U.	357 B.Th.U.
Therms per ton	172·2	162·0
P.Ct. of B.Th.U. of coal in gas made	54·5	51·5

Comp. of Gas Made.

—	P.Ct	C.Ft. per Ton.	P.Ct.	C.Ft. per Ton.
Carbonic acid	5·2	2,683	4·9	2,217
Unsat. hydrocarbons	0·5	258	1·0	445
Oxygen	0·3	155	0·4	171
Carbonic oxide	31·8	16,410	29·7	13,454
Hydrogen	49·2	25,395	48·9	22,188
Satd. hydrocarbons	5·0*a*	2,580	8·0*b*	3,642
Nitrogen	8·0	4,129	7·1	3,233

(*a*) The saturated hydrocarbons in the total gasification gas consisted of methane and some of its higher homologues of the methane series (ethane, propane, &c.), the average number of carbon atoms in the mixture being 1·22. Reckoned as its equivalent in methane, this would represent 6·1 p.ct. of methane and 3148 c.ft. of methane per ton.
(*b*) The saturated hydrocarbons in this case consist almost entirely of methane.

P.Ct. of CO_2 given by gas on complete combustion	44·6	45·6
Pounds of carbon in gas	727·5	654·
P.Ct. of carbon in original coal found in gas	41·2	37·1

A comparison of the figures here, in which the most favourable assumption is made as to the amount of coke from a ton of coal available for blue water gas production, shows in the first place that the total gasification yields 6260 c.ft. more gas per ton, or, deducting the increased amount of the inert gas CO_2 and nitrogen, an increase of 4898 c.ft. of combustible gas. The therms per ton in the gas show an increase of 10·2, equal to an increase of 3 p.ct. of the therms in the original coal.

SECOND COMPARISON.

Only the 9 cwt. of coke remaining after separation of 1·6 cwt. of breeze, assumed to be available for conversion into blue water gas.

—	Total Gasification Results.	Separate Carbonization and Water Gas Production.
Gas made per ton	51,610 c.ft.	40,600 c.ft.
Cal. value, gross	334 B.Th.U.	365 B.Th.U.
Therms per ton	172·2	148·2
P.Ct. of B.Th.U. of coal in gas made	54·5	47·0

Comp. of Gas Made.

—	P.Ct.	C.Ft. per Ton.	P.Ct.	C.Ft. per Ton.
Carbonic acid	5·2	2,683	4·8	1,955
Unsat. hydrocarbons	0·5	258	1·1	445
Oxygen	0·3	155	0·4	166
Carbonic oxide	31·8	16,410	28·6	11,614
Hydrogen	49·2	25,395	48·8	19,811
Satd. hydrocarbons	5·0*a*	2,580	9·0*b*	3,623
Nitrogen	8·0	4,129	7·3	2,986

(*a*) Average carbon value 1·22, therefore = 6·1 p.ct. of methane and 3148 c.ft. methane per ton.
(*b*) Average carbon value 1·0, consisting almost entirely of methane.

P.Ct. of CO_2 given by gas on complete combustion	44·5	45·7
Pounds of carbon in gas	727·5	586·5
P.Ct. of carbon of original coal found in gas	41·2	33·2

As will be seen, if the breeze is not reckoned as available for water gas production in the case of the mixed gas, there is a very considerable reduction in the make of gas per ton, which then comes out to 40,600 c.ft. against 51,610 c.ft. for the total gasification plant test, and the therms per ton 148·1, or 47 p.ct., of the heat value of the coal, against 172·2 therms and 54·5 p.ct. for the total gasification test. On the other hand, as the proportion of water gas made is reduced by removal of the breeze, the calorific power of the "mixed" gas becomes 365 B.Th.U., against 334 for the total gasification gas.

Generally, therefore, it will be seen that, even taking the first most favourable comparison, the results obtained in the test of Sept. 21-24 with this first total gasification plant of the type show in all respects but one a decidedly higher figure than could be obtained from the same coal by separate carbonization and subsequent conversion of the coke into blue water gas, and mixing the gas obtained in the two processes. The gain in yield of gas per ton and in therms per ton is considerable; and though there is a falling-off in the calorific value of the gas per cubic foot, this falling-off is proportionately much less than the gain in other respects.

The figures given under the heading "Separate Carbonization and Water Gas Production" are arrived at as follows:

First Comparison.

	C.ft.	C.V.		
Coal gas	13,900	× 505 =	7,019,500	B.Th.U. per ton.
B.W. gas	31,450	× 292 =	9,183,400	,, ,,
	45,350	× 357 =	16,202,900	,, ,,
			or 162 therms per ton.	

Second Comparison.

	C.Ft.	C.V.		
Coal gas	13,900	× 505 =	7,019,500	B.Th.U. per ton.
B.W. gas	26,700	× 292 =	7,796,400	,, ,,
	40,600	× 365 =	14,815,900	,, ,,
			or 148·2 therms per ton.	

ENRICHMENT BY OIL.

For the reasons given previously in this paper, it has not been possible to carry out any extended tests covering the question of carburetting oil when running the plant on coal. A number of short duration tests were made with the plant running on coal and then on coke, and also on another set running on coke, and the results indicated that there was no reason to suppose that there would be any serious difference in oil efficiency whether using coal or coke, nor were the results obtained on this set appreciably different from those obtained on an ordinary carburetted water gas set of similar capacity.

While Mr. Griggs was in America he was able to carry out oil efficiency tests under the best conditions, and was satisfied that there was no drop in efficiency when using coal. I understand that the makers are prepared to give their fullest guarantee with regard to oil enrichment.

FINANCIAL COMPARISONS.

This paper would not be complete without at least a reference to this side of the question. The financial aspects of the case are, however, so varied, and depend so entirely on the particular circumstances encountered in each individual case, that it seems impossible to deal with them adequately in the scope of this paper. There are, however, two factors which appear to stand out beyond all others—viz., capital cost and operating costs. As far as can be seen for a given capacity of plant, both these should undoubtedly be lower in the case of a complete gasification plant, if everything is taken into account; but as to the suitability of this plant for any particular works, and whether it would pay to introduce one, can only be decided by those in charge after careful consideration of local conditions.

Discussion.

The PRESIDENT (Mr. W. E. Dean, Exmouth), moving a vote of thanks to the author of the paper, said they were greatly indebted to Mr. Pearce for a contribution of high technical interest which must have cost much time and energy in its preparation. At the same time he would like to thank Mr. Soar for his assistance with the lantern.

Mr. C. F. BOTLEY (Hastings), seconding the vote, remarked that the Association were fortunate in being made the avenue to give to its members, and through its members to the whole gas industry, an account of an apparatus which might have marked effect on the future economics of the industry. He had had no opportunity of seeing the plant at Mill Hill, but he was able to form a good idea of it from the excellent description given by Mr. Pearce. The paper was really a striking commentary on the claims often made by those who urged them to turn all their coke into gas. The best figure given for the percentage of thermal units in the coal converted into gas was 54·5. He would like to ask the author whether the declared calorific value of the gas supplied by the North Middlesex Gas Company was 450 or 500 B.Th.U., and how they dealt with the difference between this figure and the low C.V. of the gas from the complete gasification plant. He recalled experiments which had been made at Harrogate. He believed that the calorific value of the gas obtained in the total gasification plant there, treating Midland coal, was 320 B.Th.U. per c.ft.; and it was this low calorific value which kept Mr. Robinson from extending the plant. Then there was the question of residual products at Mill Hill. It was doubtless difficult to arrive at the value of the tar, but information on this point would be interesting. Regarding the liquor, which, as Mr. Pearce had said, was weak, what was the volume made?

LETTER FROM MR. TREWBY.

The PRESIDENT at this stage read a letter from Mr. Trewby, General Manager of the North Middlesex Gas Company, as follows:

I am very sorry that an attack of bronchitis prevents me from being present to listen to Mr. Pearce's paper and take part in the discussion, but I have obtained an advance copy and have written a few notes on the plant. You will gather from Mr. Pearce's paper that this plant has had a long and varied career before being presented in public as a satisfactory unit to be used for gas-making; but when I was asked by my friend Harris, some years ago, for permission to make this experiment, after permission of the Directors was obtained, I made up my mind that I would not allow any experimental plant at Mill Hill to be talked about or seen until I was

absolutely satisfied that it was a mechanical and chemical success. Humphreys & Glasgow were just as keen to make the first plant completely successful; and that is why it has been so long in being introduced to the public. At one time I thought it would be impossible to achieve the success we wanted, but by the hard work of Messrs. Humphreys & Glasgow (especially that of Mr. Griggs), and with the help of my staff, the seeming impossibility has been achieved.

Over 5000 tons of coal have been put through the plant, and over 2000 tons this year; and the plant is now being worked as an ordinary unit of production, and not as an experimental plant at all. My Board were so satisfied with the plant on the report I gave that another unit has been erected of practically the same size, with some improvements, so that now I am in a position to make 1½ million c.ft. of carburetted water gas by means of about 25 tons of coal per day, or 25 tons of coke. Thus I am completely independent of the coke market.

No sulphate of ammonia is produced, as the liquor is too weak to be of any use. The tar seems quite good, with about 12 p.ct. of water; this we are going to treat in a Sharples plant.

The plant requires a little more attention than the ordinary carburetted water gas plant, and I put my chemical staff in charge, as the great thing is to keep the heat balance correct. The only "snag" is that, when using coal in place of coke, the output of the plant is only 750,000 c.ft., in place of 1,000,000 c.ft. on coke; and I see no prospect of increasing the throughput of coal in order to raise the output of gas.

In conclusion, may I say how pleased I was to put my works and staff at the disposal of Messrs. Humphreys & Glasgow in order to experiment with this plant, and how delighted I am at the successful issue, because I have a very vivid recollection of the visit to America nearly forty years ago of my late father, Mr. G. C. Trewby, who went over to investigate the possibilities of carburetted water gas for the Gas Light and Coke Company. The first plant was erected at Beckton under his supervision, and then, as we all know, Mr. Glasgow came over and erected plants all over the country. I can only hope that this plant, which has been described to you today, will prove as successful for the gas industry and Messrs. Humphreys & Glasgow as the original carburetted water gas plant introduced over forty years ago.

Mr. McLusky's Communication.

The PRESIDENT read the following letter from Mr. W. B. McLusky, of Halifax:

The paper on complete gasification should excite interest in the Southern District. Of course, you know that, when coal is plentiful, neither carburetted water gas nor complete gasification can be made to pay in these parts. We get the best coal in Yorkshire delivered at less than £1, and we expect 20,000 c.ft. of gas per ton. The gross cost of coal is therefore about 1s. per 1000 c.ft, and the net cost is about 4d. per 1000 c.ft. Purification and repairs and maintenance of works add 7·53d., making the total works cost about 1s. This gas averages about 412 B.Th.U., and we sell it at 2s. per 1000 c.ft. *plus* a quarterly fixed charge. Our carburetted water gas plant can work very economically on either blue gas or carburetted water gas. With coke at 25s. per ton, you will appreciate that blue gas of 300 B.Th.U. would cost us about 4d. per 1000 c.ft. for fuel alone.

Points in Favour of Complete Gasification.

Dr. H. G. COLMAN said they would understand that it had not been possible to make an absolutely complete test of the plant at Mill Hill. When a plant was working in conjunction with other carburetted water gas units, it was, of course, exceedingly difficult to arrange matters in the works to enable a continuous run of sufficient duration to allow of thoroughly reliable results. In the 72-hour test reported in the paper, they had an anxious time during the last 36 hours, watching the holders. They did, however, just manage to pull through. It was impossible to determine some points. For instance, they could not arrive at reliable figures of the production of tar and ammonia, owing to other plant being in operation. Then they could not determine the amount of steam used in the process. It was always desirable to obtain a carbon balance, but to do this involved measurement of the carbon in the gases passing away through the stack valve, which, as they would appreciate, was an intricate task. His figures gave the amount of carbon contained in the gas as a percentage of that in the original coal, but he had no figures relating to the quantity of carbon in the tar or in the waste gases. The test was particularly interesting because it had been made on a plant which was not primarily designed as a complete gasification unit, but which was a modified water gas plant. He would remind them, of course, that the test was carried out two years ago. One hardly expected maximum results, but it was interesting to see how well the plant functioned, and to observe the high degree of technical success attained. He had little doubt that, with the new plant, based on the experience of the one tested, still better results would be obtained. There was one point which he would like to emphasize a little more. It was true that, compared with two-stage working—carbonization in horizontals and gasification in water gas plant—the one-stage total gasification plant gave a higher yield of gaseous therms per ton of coal, but that the calorific value of the mixed gas was lower. If they desired to make as rich a gas as possible, then separate plants were indicated, but the gaseous thermal yield would be correspondingly less as the calorific value of the mixed gas was raised.

A Gas Supplier's Ideal.

Mr. P. G. G. MOON (Bournemouth) suggested that the paper went along the lines of an ideal which had been at the back of his mind for a long time—that gas undertakings should send out gaseous fuel only. They had yet to see whether this was outside the range of practical commercial politics; and they might be disappointed with the results referred to by Mr. Botley. A thermal efficiency of 54 p.ct. appeared low, but in itself it was a hopelessly incomplete statement, for no account was taken of the heat units introduced in the form of steam and recoverable by waste-heat boilers, and of the thermal value of the tar. Until such figures were available, it was too early to be disappointed with the figure of 54 p.ct. compared with that of 70 to 75 p.ct. representing normal practice. There were other practical considerations. In spite of a lower thermal efficiency, it might be possible to sell coke in the form of gas to better advantage than as solid fuel. If they set out to fulfil the ideal of supplying only gaseous fuel, they would have to consider the effect of distributing gas of a lower calorific value and having a high carbon-monoxide content. Personally, he thought that the question of quality could be met, and that they ought to feel confidence about the carbon-monoxide content, which was a bogey. It might be suggested that this bogey would loom larger if the gas contained (say) 40 p.ct. of carbon monoxide, as against (say) 25 p.ct. But if people were determined to commit suicide, they could do it just as well with gas containing 25 p.ct. of carbon monoxide as with gas containing 40 p.ct.; and potential suicides should not be allowed to stop the progress of the industry if this was indicated by complete gasification. Though monetary considerations might at present stand in the way, they ought to adjust their point of view regarding the conversion of the whole of the coal into gaseous fuel. It was an ideal at which they ought to aim.

Cost the Main Factor.

Mr. J. WESLEY WHIMSTER (Bath) said that it was interesting to know that a plant had been devised to gasify coal completely and successfully; but the main factor was that of cost, and in the paper no relative figures were given for the cost of manufacturing gas in the total gasification unit as compared with two-stage working—coal gas and water gas. Mr. Trewby had said that now he was independent of the coke market. This, of course, was very convenient; but if coke difficulties meant the supply of cheaper gas, then complete gasification went by the board.

Mr. W. H. WARREN (London) advanced the argument that the plant described by Mr. Pearce might be taken as putting more coke on the market.

Mr. G. M. GILL (London) mentioned that a year ago, in America, he saw a carburetted water gas plant which consumed its own ammoniacal liquor. This process produced a weak liquor, and the whole of it was sprayed into the top of the superheater during the back-run period. It had been working successfully for twelve months, without any difficulties, and the output of the plant was about 2½ million c.ft. of gas per day. This was not an isolated example, and he wondered whether the idea had been considered at Mill Hill; it was certainly deserving of some attention.

Mr. A. H. ANDREWS (London) said that, whatever the future might hold for the distribution of fuel solely in the gaseous form, the question of cost could not be set aside. He had noticed that the plant at Mill Hill treated one class of coal, but many undertakings did not or could not obtain a supply of South Yorkshire nuts; and consequently, if the plant could deal with unscreened Durham coal, its adaptability would be increased.

Mr. FRANK LIVESEY (Maidstone) suggested that there might be slight danger during the clinkering process of the plant at Mill Hill. If they referred to fig. 2 of the paper, it would be seen that coal gas in B would be drawn off to washer E, and then through H to washer F. The outlet of washer F was subject to the back-pressure of the plant. How was the coal gas drawn away safely without passing to the clinkering door?

Mr. E. G. STEWART (London) asked what was the maximum calorific value of the plant when using oil. With the back-run process there was a limit to the amount of oil which could be carburetted. In other words, there was an upper limit to the calorific value of the gas produced. He had seen comparisons of the combined process—carbonization and water gas manufacture—and of complete gasification which appeared very similar; but when they took into account the steam used in the latter process, the figures of therms per ton of coal were reversed, and the two-stage system of retort house and water gas plant was miles ahead. He would like to know the amount of power and steam used on the plant at Mill Hill, the labour costs, and also the cost of the plant itself.

The Author's Reply.

Mr. PEARCE, replying to the discussion, first of all answered Mr. Botley's query regarding the declared calorific value of the gas supplied by the North Middlesex Gas Company. This, said Mr. Pearce, was 500 B.Th.U. The tests were carried out on the plant using coal only; but in ordinary working, the gas was always carburetted. The Harrogate plant mentioned by Mr. Botley was using Midland coal, and, in comparison, the coal employed at Mill Hill was better; the results obtained there showed a calorific value of the gas between 340 and 345 B.Th.U. per c.ft. Unfortunately, he had no definite figures relating to the tar produced, but they had no difficulty in disposing of it; the tar distillers raised no objections to it. It contained rather a high percentage of water, but, as had been mentioned in Mr. Trewby's communication, they were going to instal a centrifugal machine. The ammoniacal liquor was very weak, about 0·2 oz. strength. At Mill Hill they had a very fine coke market, and the object of installing the complete gasification plant was to employ coal rather than coke for the manufacture of gas. If Mr. Moon referred to the tables in the paper he would see that the carbon monoxide content of the total gasification gas was very little greater than that of the mixed gas consisting of retort gas and water gas. The figures were 31·8 and 29·7 p.ct., and 31·8 and 28·6 p.ct. respectively. He would assure Mr. Gill that sight was not being lost of the possibility of utilizing the ammoniacal liquor in the plant itself. A point of importance had been raised by Mr. Andrews. They used South Yorkshire nuts simply because it paid them to do so in view of

the coke market. Durham coal had been employed in the plant, but Durham unscreened coal would decrease the throughput, and hence the output, of the plant. He did not think he was wrong in stating that the plant would deal successfully with any type of coal. Mr. Livesey had raised the question as to what happened to the coal gas during clinkering periods. The hot gas valve was always closed, and the gas could not escape at the stack valve. If no other means were provided, it would escape at the clinkering doors. A steam injector, however, was fitted to draw away the gas to the washer; and there was no danger of the gas passing out at the clinkering doors. Mr. Stewart had asked what was the maximum calorific value of the gas obtainable from the plant. Well, they could get all they wanted; the usual amount of carburetting resulting in a gas of from 450 to 470 B.Th.U. per c.ft. Then Mr. Stewart had asked for the costs of steam and power. The power taken by the fan was 9 H.P., and the quantity of steam was no more than that required for an ordinary water gas plant. It was difficult to state the labour costs, because these must differ according to the varying conditions on different works. The plants at Mill Hill had a capacity of 750,000 c.ft.; and even if they had double that capacity, they would need no more than two men per shift. He was not prepared to advance capital costs, but, speaking generally, they were far below those for coal gas plant, taking everything into account.

PUBLIC WORKS, ROADS, AND TRANSPORT CONGRESS AND EXHIBITION.

Royal Agricultural Hall, Islington, Nov. 18-23.

We outline below a few of the interesting exhibits at this Exhibition.

John Allen & Sons (Oxford), Ltd., showed, among other things, an example of the "Allen-Parsons" trench excavator. The capacity of the standard machine is for trenches up to 24 in. wide by 7 ft. deep, but trenches up to 42 in. wide can be dealt with by means of additional side cutters. Even wider trenches can be cut by digging several parallel trenches and removing the thin dividing walls. Motive power is provided by a 40-H.P. petrol engine of rugged and simple construction. The machine can travel from job to job under its own power, at 1⅛ or 1½ miles per hour, and is thus practical even for digging short trench jobs. Sixteen speeds are available for the actual digging operation. When the work lies several miles distant, the machine can be loaded by its own power on to a wagon for transportation. The firm hire this machine to gas and water undertakings.

British Road Tar Association.—This stand was an information bureau wherein all those interested in the use of tar had an opportunity of discussing questions concerning its use and application for road-making. Samples of road tar, in accordance with the Association's Specifications, were to be seen, and among the exhibits was an interesting section of Roman road, which, in contrast to the modern sections of tarred roads, showed the development that has taken place in road construction since the Roman period.

British Taroleum Company, Ltd.—The display of this firm included "Taroleum" binder, hot spraying compound, cold emulsion, cold grout, and bituminous paint.

British Steel Piling Company, Ltd.—On this stand were exhibited various sections of steel-sheet piling; working models of pile-driving plants, including McKiernan-Terry pile-driving hammers, one driving under water; a model "Vibro" plant demonstrating the making of "Vibro" concrete piles; and models of important civil engineering works, showing the use of steel-sheet piling.

Chaseside Engineering Company.—The exhibit of this firm consisted of a Chaseside "Hi-Lift" shovel and a Chaseside "Lo-Lift" shovel. These vehicles were built to provide a rapid and economical means of loading all descriptions of loose materials; to cut out the slow and expensive method of hand-shovelling; to attain easy and speedy access between loader and wagon, lorry, or dumping ground; to save double-handling; and to make loading a profitable proposition. How successfully the Chaseside has achieved these objects is proved by the ever-increasing demand for its services.

Constable, Hart, & Co., Ltd.—Samples of asphalt carpet surfacings, slag tarmacadam, limestone tarpaving, and "Aztec" all-weather bituminous emulsion, were included in a comprehensive exhibit of this firm's manufactures.

Expanded Metal Company, Ltd.—Here were shown samples of the Company's various products, together with photographs of a few of the more important municipal works carried out on their systems. Among the items exhibited were "Expamet" RR reinforcement for concrete roads, &c.; "Expamet" expanded steel-sheet reinforcement for concrete, which has been used extensively for foundations, floors, roofs, bridges, culverts, &c.; "Expamet" and "BB" lathing for plasterwork; and "Exmet" reinforcement for brickwork, concrete blockwork, &c.

Gas Light and Coke Company.—The central feature of the exhibit was one of the Company's fleet of road-spraying tanks. Samples of tars, emulsions, and treated sections of road were also displayed.

Hans Renold, Ltd., showed a series of stock drives 1 to 100 H.P. mounted on a steel frame, together with an elevator chain in motion; chains and accessories for use on counter-weight; suspension sets, racks, &c.; samples of chains; and photographs of typical chain applications.

Holman Bros., Ltd.—On this stand were exhibited Holman portable air compressors. The Hele-Shaw Beecham compressor proved of great interest. This consists of three well-finned cylinders formed in one casting which rotates on ball and roller bearings about the fixed central water-cooled valve, in which the air inlet and discharge ports are formed. The pistons are carried by roller bearings on floating annular rings, the centre of which is eccentric to the valve centre. Therefore, when the cylinder rotates, the pistons move relatively to the cylinder, and the same processes of air suction, compression, and delivery which take place in the ordinary type of reciprocating machine are present in this one.

The Horstmann Gear Company, Ltd., displayed a complete range of their automatic gas controllers and electric time switches for public street lighting, including their "Newbridge Junior" gas controller and electrically wound time switch. The Company also exhibited their "Newbridge" positive distance gas switch for the remote control of indoor gas lamps.

The Lead Wool Company, Ltd.—Samples of lead wool and of lead wood joints were shown; also caulking tools, apparatus for testing the joints of large-diameter pipes without filling the pipeline, air compressors, and metallic packings.

Reavell & Co., Ltd., showed three sizes of portable compressor sets, petrol-engine driven, with capacities of 74, 118, and 153 c.ft. per minute respectively. The two smaller sets incorporated vertical single acting compressors, while the largest included a compressor of the "Quadruplex" type. All sets were mounted on portable chassis with road wheels.

Tarmac, Ltd.—The exhibits of this firm included samples of all gauges of "Tarmac." It is worthy of record that "Tarmac" is now being produced to a total of well over a million tons per annum. Tarmac, Ltd., have twenty works operating in twelve counties.

Thomas & Bishop, Ltd.—"Permac" jointing material was featured by this firm. The universality of the use of "Permac," combined with its efficiency and extremely cheap initial cost, was demonstrated by a series of joints which included flanges, screwed-piping, and fittings. The joints were lowered into an illuminated tank with a glass front, and were all under water. Air, compressed to a pressure of 140 lbs. per sq. in., was automatically applied through an inlet valve and released through a safety valve three times a minute. The efficiency of "Permac" joints was shown under this severe test. In addition, the amount of waste by inefficient and leaky joints was exhibited.

Weston, Shipley, & Weston, Ltd.—"Kut-Out" pipe cutting machines, "Driltaparatus" under-pressure drilling and tapping machines, and a new under-pressure bagging apparatus for gas mains were shown by this firm.

John Yates & Co., Ltd., exhibited shovels, spades, forks, &c.

Presentation of a Mallet to the North British Association of Gas Managers.—In the course of his speech at the luncheon at the Autumn Meeting of the North British Association of Gas Managers, Provost Boase, of St. Andrews, mentioned that, as a memento of this year's meeting, he would be very pleased to present the Association with a Chairman's mallet. We are informed by Mr. Archibald Kellock, the Secretary of the Association, that the mallet has now been forwarded to him. The mallet is of ebony, with a silver nameplate inscribed as follows: "Presented to the North British Association of Gas Managers by W. Norman Boase, Provost of St. Andrews, September, 1929."

GRANTON GAS-WORKS.

Visit of Scottish Juniors.

The Scottish Junior Gas Associations, along with a number of the leading Scottish Gas Engineers, visited Granton Gas-Works of the Edinburgh Corporation on Saturday, Nov. 16, at the invitation of the Gas Committee.

Councillor Gregorson, Convener of the Gas Committee, Treasurer Harvey, along with Mr. Gracie, the Engineer, and his Chief Assistant, Mr. J. Jamieson, extended a hearty welcome to a company of nearly 200.

The party were taken round the works by members of the Staff, and particular attention was paid to the new waterless holder in course of erection by Messrs. R. Dempster & Son, Elland; the new sulphate plant installed by the Chemical Engineering ond Wilton's Patent Furnace Co., and the "Connersville" meters, by Messrs. W. C. Holmes & Co.

Descriptive booklets of the new plants had been prepared, and from these the following data have been extracted.

WATERLESS HOLDER.

The waterless holder came in for special attention, as it is the first one to be erected in Scotland. It will have a maximum delivering capacity of 5 million c.ft. of gas. The outer steel shell is polygonal in plan, having 24 sides formed of specially constructed flanged plates with corner posts of rolled steel joists, and measures 176 ft. across the corners of the polygon. The base of the holder is formed of steel plates which rest on a concrete foundation slab, while the top, or roof, consists of a braced steel framework of 24 radial trusses connected at the inner ends to a heavily designed ring bracing, and at the outer ends to the tops of the steel corner posts. Timber rafters are secured to this roof bracing, and these covered with tongued and grooved boarding, finished with two layers of bituminous roofing felt. The centre is surmounted by a specially designed ventilator. The sides of the holder are stiffened laterally by means of five steel galleries running all the way round, which, in conjunction with the handrailing, combines architectural ornamentation with utility. The piston or disc fixed in the interior of the shell is a steel braced structure with gas-tight flanged plate flooring.

The introduction of this type of gasholder from the Continent is not without adequate reasons. The comparison of this form of gasholder of 5 million c.ft. capacity with one of the ordinary column-guided design will reveal the reasons for the choice.

By means of the ingeniously designed tar seal, which is only about 2 ft. deep, the tank used for the water seal in a telescopic holder is dispensed with, making an approximate total reduction in the weight of the structure of about 1000 tons; the total load on the foundation being 1500 tons, instead of 42,500 tons in the case of a steel tank and telescopic holder (including water). The load on the general surface of the foundations does not in the present structure exceed 100 lbs. per sq. ft., and the excavations from the circumferential foundation wall are tipped over the site. Whereas it is general practice to make the height of a spiral holder equal to its diameter, in the case of the waterless holder, on account of its design, this proportion can be greatly increased.

This 5 million c.ft. capacity holder is 176 ft. diameter by 235 ft. high, but this height can be added to so as to increase the capacity. The piston can be loaded to give any desired pressure at the outlet up to (say) 20 in., but the holder must be designed in the first place to be adequate for the ultimate working pressure. The Granton holder will give a maximum pressure of 12 in. During storage, the gas is not suspended over a column of water, as in the ordinary type of gasholder, and this presents a great advantage in keeping the gas dry, and is also a saving financially.

"CONNERSVILLE" METERS.

The "Connersville" station meter has a normal rated capacity of 325,000 c.ft. of gas per hour, and when passing this quantity of gas the meter runs at a speed of approximately 225 revolutions per minute. At one end of the meter is an instrument which records on a chart the quantity of gas passed for each hour of the day and also shows the variations in temperature and pressure throughout the twenty-four hours. One of the outstanding advantages of this type of meter is the extremely small space required, which for the meter at Granton is 8 ft. 11⅞ in. by 4 ft. 6⅜ in. by 6 ft. 10½ in. A second meter of this type is fitted at the water gas house. This meter is fixed on the outlet of the relief holder, and has a capacity of 150,000 c.ft. of gas per hour at 220 revolutions per minute, the space occupied in this instance being 7 ft. 11⅛ in. by 3 ft. 6¾ in. by 5 ft. 9 in.

WILTON'S SULPHATE PLANT.

The new process for manufacturing, neutralizing, and drying sulphate of ammonia was also inspected and the operations explained.

The salt, as produced, is discharged from the saturator into a receiver, from which any surplus mother liquor overflows back to the mother liquor well. The receiver is mechanically operated and fitted with special acid resisting scraper conveyor, which runs at approximately three revolutions per minute. This very slow running reduces the amount of splash, and also keeps wear and tear down to a minimum. The sulphate is then delivered continuously to a monel metal travelling belt under which are fitted suction shoes to remove moisture. This belt is specially woven and of a metal which is both alkali and acid-resisting. As this belt passes forward and discharges the salt into the drier, it continues to travel through a water bath on the under side of the conveyor, thereby ensuring that the belt is thoroughly cleansed and washed, and in perfect condition to receive a fresh batch of sulphate. When thoroughly dried, the salt leaves the final drying machine through a perforated plate, which prevents any lumps being passed, and it can either be automatically delivered direct into bags or stored in a house provided for it. The final sulphate does not contain more than about 0·1 p.ct. moisture, and is of neutral crystalline quality of the best grade, generally testing about 21·15 p.ct. of nitrogen.

THE VISITORS WELCOMED.

Councillor GREGORSON, Convener of the Gas Committee, welcomed the visitors on behalf of the Corporation and the Gas Department of the city. It was always pleasing, he said, to anyone, Corporations or individuals, to show possessions of which they were proud to people who could appreciate and be interested in such things. He hoped sincerely that they had had an interesting afternoon, and that the new plant in these works, completed or in course of construction, had been a source of interest to them. Their new waterless gasholder, the necessity for which had been brought about by the very great increase in the demand for gas, would be, he believed, the first of its pattern erected in Scotland. He was not going into details as to capacity, dimensions, &c., as they had already gathered all that information. When it rose to its full height, he had no doubt that it would excite criticism, but he trusted that the public in general would keep in view that, from necessity, the choice lay between another holder similar to their existing one and the new and, he believed, more efficient type in course of erection, and that the erection of the latter meant a saving to the Department and necessarily the consumers of at least £20,000. When it rose to its full height and was visible from a great distance it would at least be a monument and sign of the increasing demand for gas and a sign that the industry was not moribund, as the keen protagonists of a sister industry would like to make out. He might, in fact, compare it to the steel erections appearing all over the countryside which proved that their sister industry also was progressing. He wished all good fortune to both of them. They were both doing much to remove the terrible scourge of smoke in the atmosphere and reducing the great waste caused by the burning of raw coal.

In Edinburgh, the output had since 1920, when the undertaking was taken over by the Corporation, increased by 804 million c.ft., and the price had, in the same period, fallen from 5s. 8d. to 3s. per 1000 c.ft. Incidentally, Mr. Gracie was appointed Engineer and Manager in 1921, and was soon joined by his able Assistant, Mr. Jamieson, and it was owing largely to their ability and industry, backed by a loyal and willing staff, that the good results he had mentioned had been attained.

Mr. H. H. GRACIE, Engineer and Manager, said this was an unusual occasion, and he was pleased to see so many of the Juniors with them that afternoon, and to observe how keen and interested they were in the progress of the industry. He hoped they had seen some plant and methods of construction which would prove useful and helpful to them. They felt the opportunity of seeing the construction of a tankless holder was one which seldom arose, and as their holder had reached a stage where the details of construction could be seen and studied they felt the chance should not be lost. The response to the Gas Committee's invitation to visit the works was a very gratifying one. They would probably be interested to learn how the Corporation decided to proceed with the erection of a holder of this type. A small deputation went over to Germany and France and saw a number of the waterless holders there. They left, no doubt, with somewhat mixed feelings as to the possibilities of this type of construction. The Convener and Vice-Convener were mainly concerned with the outward appearance and the architectural features from the amenity point of view, and it was thought by some that it would fail on this point.

"ARCHITECTURAL GASOMETERS."

He was anxious to satisfy himself on the question of safety, on the engineering possibilities, first cost and working costs, and, especially, as to the risk of leakage. He thought he might say that they were all favourably impressed with the general appearance of these holders, and some felt that they were not nearly so objectionable looking as had been anticipated; indeed, they were agreeably surprised, and were almost agreed that they improved the beauty of the landscape, at least when compared with some of the other structures. Since these holders had been completed here, they had been referred to by competent critics as "architectural gasometers." As regards safety, he ascertained that holders of the tankless type, of which there were many on the Continent, had withstood some very severe gales; indeed, one actually came scatheless through a

tornado in Florida a few years ago, when many other buildings were destroyed. As regards the engineering construction, he was agreeably surprised to find the great care and accuracy which were expended in the design and construction of every part of the holder, and, on the subject of leakage, he climbed to the top of all the holders visited and descended inside to the top of the piston, though there was over 2° of frost and his gloves stuck to the iron railings, and in no case was there the slightest indication of any leakage or smell of gas.

When they received the tenders for the new holder, they found that there was a very considerable saving—about £20,000—with this waterless type, compared with the spiral or column-guided holder. They would readily understand this saving when they recalled that for foundations only a strong concrete ring and solid concrete bottom were required, as against the heavy excavations and building necessary for the water tank with the older form of gasholder. Again, as the shell was a permanent fixture and not subject to movement, nor was it continuously in and out of water like the ordinary type, the wear and tear would be much less, and consequently the upkeep and painting would be reduced. The cost of this when it came to be done would also be less, as the galleries round the holder gave ready access for this work.

As the sealing of the interior piston which rose and fell according to the amount of gas in the holder was most important, and it was essential that this should be absolutely gas-tight, its construction would have had the visitors' special attention, and they would have seen how cleverly this was effected by means of tar, which not only provided the seal referred to, but also acted as a lubricant for the piston as it travelled up and down in contact with the sides of the container. He need scarcely remind them of the freedom from risk of freezing, the saving in anti-freezers, steam piping, boilers, and attendance in the winter time.

As regards the painting and finishing of the new holder, it was their intention to select colours which would make the structure as inconspicuous as possible, and give it the effect of melting into the landscape, and he was hopeful that their efforts in this direction would meet with success.

TAR PUMPING.

As regards the tar pumping, this was a somewhat simple matter, and the cost of running the pumps was a comparatively small item. No doubt this type of holder should be inspected more often than the ordinary type, but they had provided a lift connected with each of the galleries, and also with the room, so that access to the interior was simple and convenient. The man in charge of the station meters and boosters and present holder would look after the new one. As the pressure with the new holder—viz., 12 in.—was a constant one, and considerably in excess of the old type, they would be able to fill several of the "in-town" gasholders direct, so that the boosters would have less to do and require less attention.

Mr. JOHN SCOBIE, President of the Eastern Juniors, thanked Convener Gregorson and Mr. Gracie for the very hearty welcome they had received and for the hospitality extended to the large number assembled.

Mr. RONALD D. KEILLOR, President of the Western Juniors, in supporting Mr. Scobie's appreciation, suggested that the Edinburgh undertaking, in erecting a waterless holder, were erecting a monument to the progress of gas.

Treasurer HARVEY said there was no more outstanding example of the threatened man living long than the position of the gas industry to-day, as compared with its position 40 years ago, when its doom was loudly proclaimed because of the introduction of a competitive agency. Continuing, he observed that low-temperature carbonization would make no real headway in this country until it was possible to produce a smokeless fuel of lower cost and higher relative heat value than raw coal. So far as the gas industry was concerned, low-temperature carbonization was purely an economic question, and if, as the result of researches being carried on, its method of treatment of coal were proved economic, the gas industry, which had never been slow to grasp the significance of any development, would not be behind in the race for the production of a smokeless fuel. In saying this, he was not admitting that the gas industry had failed to contribute to the great problem of smoke abatement. While little popular credit had been given to it for its efforts in this direction, the fact remained that there had been a very much greater contribution to smoke abatement through the medium of the gas industry than from any other source in the country.

Mr. FULTON, President of the North British Association of Gas Managers, extended a very hearty vote of thanks to Convener Gregorson, Mr. Gracie, Mr. Jamieson, and the staff.

LOW-TEMPERATURE CARBONIZATION OF COAL.

[From a Paper by Harald Nielsen before the Manchester Association of Engineers, Nov. 8.]

At a Meeting of the Manchester Association of Engineers held on Friday, Nov. 8, Mr. Harald Nielsen read a paper entitled "Low-Temperature Carbonization of Coal." Mr. James A. Robertson, M.I.E.E., presided.

Dealing with gaseous products of the "L & N" process, Mr. Nielsen referred to the gas evolved by low-temperature treatment. It was found that the quantity of gas obtained when producing a residual fuel relatively high in volatile matter was only of the order of from 12 to 15 therms. It was possible to recover this as a high calorific value gas, but for large-scale industrial application the recovery plant would be cumbersome, and no allowance was made for any revenue from the gas, beyond assessing the heating value of the gas therm at 20 to 25 p.ct. greater than the therm in the solid residue. If the object was to obtain the highest possible amount of gas—that is to say, where the process was applied to gas-works—then naturally the solid residue would have to be raised to a much higher temperature in order to expel the gaseous constituents. This could be done by a straightforward distillation process employing gas inlet temperatures of the order of 1000° to 1100° C. The oil obtained was still a true primary oil, since all that happened in the distillation retort when the gas and the coal were in counterflow was that the oil zone was shifted farther up towards the exit of the retort, so that the distillation conditions under which the oils were produced were entirely independent of the inlet temperature of the gas. All that happened when employing higher temperatures was that the volatile matter in the residue was reduced.

Mr. Nielsen then referred to figures originally published in the "JOURNAL" for Feb. 10, 1926, under the title of "Long Distance Transmission of Gas." The figures were included in the paper as an appendix. Examples were dealt with of the gas evolved from various kinds of British bituminous coals, non-coking, medium-coking, and coking. The first of two Tables gave particulars of the gas evolved from the coal by low-temperature treatment and the gas evolved by the subsequent distillation of the solid residue at much higher temperatures. The second Table indicated the analysis of the gas obtained when starting with an inlet temperature of about 1000° C., which corresponded to heating up the solid residue to about 900° C. It would be seen that the gas was an excellent town gas. It was less in volume by 2000 to 3000 c.ft. than was usually obtained by ordinary gas-works practice; but it must be remarked that the difference was obtained in the form of a low-temperature oil—about 20 gallons of anhydrous oil, as against 9 to 10 gallons of high-temperature tar.

In the "L & N" process, he continued, it was possible to employ as a heating medium all sorts of gases, such as combustion gas, unignited producer gas, unignited water gas, and a circulating gas corresponding in composition to that given off by the coal at low temperature or higher temperature as the case might be. If a gas other than combustion gas and straight unignited producer gas was employed, it would be necessary to re-heat it to the distillation temperature desired. This could be done in a set of Cowper stoves, in which powdered fuel or combustion gas raised the temperature of the checker brickwork to the necessary height, the combustion gases leaving the checker brickwork being utilized for pre-drying the raw coal or for steam raising purposes. The circulating gas used for distillation would then be superheated to the necessary temperature in the checker brick chambers, and these should be changed over at suitable intervals, exactly as was the case with regenerators for open hearth furnaces. The circulating gas or the distillation gas would be enriched with the low-temperature gas evolved from the coal substance, to an extent which depended upon the distillation temperature employed. If no use could be found for the gas, it was quite clear that it was of no advantage to extract the volatile matter from the residue beyond the amount which could be recovered as oil subsequently and the small amount of gas usually associated with all thermal decomposition of coal; and it was also desirable that as much as possible should be left in the solid residue in order to obtain as high a weight percentage as possible.

Large gas undertakings were beginning to show increasing interest in the low-temperature treatment of coal. This appeared to be mainly due to the fact that the public were gradually being educated to the fact that a smokeless, easily ignited fuel was required for domestic purposes, and gas undertakings were the natural suppliers of such fuels, not only in the gaseous but in the solid form. Gas undertakings had a monopoly for the supply of gas, and though their coke products were in open competition with raw coal for domestic use, they possessed distributing facilities, and were able to save the middleman's profit to a large extent. They were really in a far more advantageous position to dispose of a solid domestic fuel than a manufacturing concern, which did not possess any monopoly and had to employ middlemen, and pay heavy freight and handling charges. It therefore seemed that, so far as the domestic side was concerned, the developments contemplated by the gas-works were along very sound lines. It was, of course, all a question of being able to produce the goods at an attractive price. It was quite clear that disappointment and failures would be experienced by the gas-works before they were "out of the wood;" but to sum up their advantages, they had a sales organization, a monopoly, a trained staff and handling facilities, and, Mr. Nielsen stated, it was his belief that they would make a success.

ASPECTS OF THE CARBURETTING PROCESS IN WATER GAS MANUFACTURE.

By A. G. GRANT, M.Sc., Assoc.M.Inst. Gas E., of the Gas Light and Coke Company.

[From a Paper before the London and Southern District Junior Gas Association, Nov. 22—Mr. F. S. Larkin, of the Gas Light and Coke Company, in the Chair.]

The author has endeavoured to give a general, albeit rather cursory description of the production of gas oil, and of modern views in regard to its nature and utilization. The subject is of great practical significance in the light of the present day importance of process and thermal efficiencies.

Referring to the production of gas oil in the petroleum industry, the author described in detail the plant illustrated diagrammatically in fig. 1.

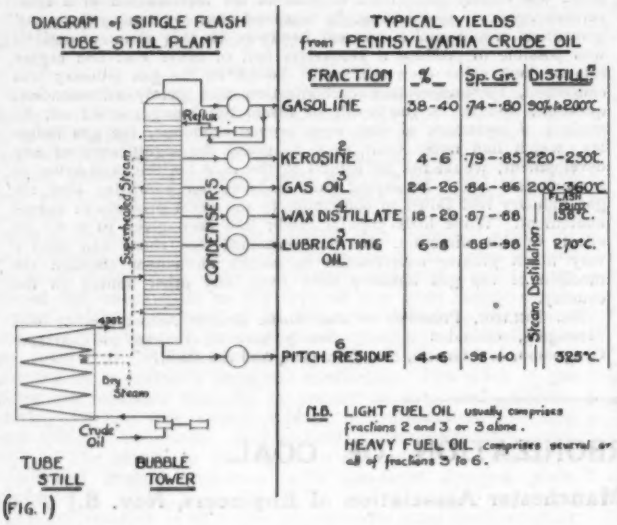
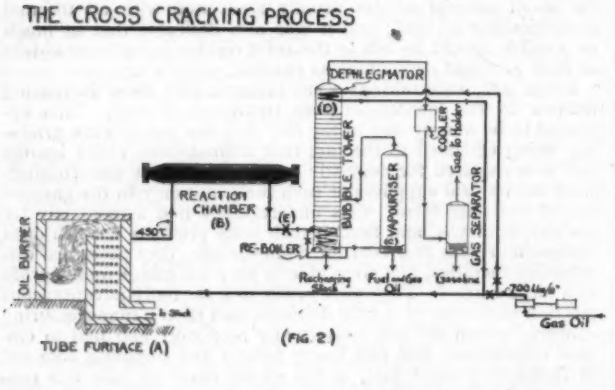


DIAGRAM of SINGLE FLASH TUBE STILL PLANT
TYPICAL YIELDS from PENNSYLVANIA CRUDE OIL
FRACTION
%
Sp. Gr.
DISTILLS
1 GASOLINE 38-40 ·74-·80 90% to 200°C.
2 KEROSINE 4-6 ·79-·85 220-250°.
3 GAS OIL 24-26 ·84-·86 200-360°C
4 WAX DISTILLATE 18-20 ·87-·88 150°C.
5 LUBRICATING OIL 6-8 ·88-·98 270°C.
6 PITCH RESIDUE 4-6 ·98-1·0 325°C.
Flash Point
Steam Distillation
Reflux
Superheated Steam
CONDENSERS
Dry Steam
Crude Oil
TUBE STILL
BUBBLE TOWER
N.B. LIGHT FUEL OIL usually comprises fractions 2 and 3 or 3 alone.
HEAVY FUEL OIL comprises several or all of fractions 3 to 6.

(FIG. 1)

It will be seen from the table of yields that gas oil is in the nature of a "middle" distillate, being actually a heavy kerosene, and that a good American crude, such as those obtained in the Mid-Continent and Pennsylvanian fields, yields 25 p.c. of this oil.

"Straight-run" oils, resulting from the tube still and older methods of distillation, are eminently suited to carburetting work. Unfortunately, however, for the gas industry, it has been found possible, and profitably so, to enhance the total yield of motor spirit by subjecting these oils and other heavy fractions to what is known as a "liquid phase cracking treatment." In this process, by the action of heat and pressure, the oil is cracked in a less drastic way than occurs in carburetting, yielding gasoline and a cracked oil somewhat heavier than the original. Since the introduction of such methods by Burton in 1913, an enormous cracking industry has grown up, and of its many plants, one of the best known is the Cross, illustrated diagrammatically in fig. 2.



(FIG. 2)

The original stock treated in this plant may be gas oil, a longer fraction containing gas oil, wax, and lubricating oils, or "topped" crude (*i.e.*, crude oil from which only gasoline and kerosine have been distilled). The nature of the heavy oil left will therefore depend on the type of stock used, but in any case the gas oil produced from it is a degraded product.

The results of this process are truly remarkable, the yields of gasoline from the cracking of a good class Mid-Continent gas oil being normally 60-70 p.ct., and in some cases as high as 80 p.ct.

In consequence of the developments that have taken place in the cracking industry, it has been possible to meet the ever-growing demands for motor spirit without proportionately increasing the amount of crude oil distilled. Over 30 p.ct. of the United States gasoline is now a product of cracking processes, and from this it can be deduced that between 20 and 25 p.ct. of the "fuel and gas" oil fraction has been subjected to cracking; if this 20-25 p.ct. is mixed with the remaining 75 p.ct. of straight-run oil, the bulk degradation is obviously considerable.

Of the gas oil now obtainable, a serious proportion has evidently undergone what might be termed "incipient carburetting" and is correspondingly inferior as a gas-yielding agent when subsequently used in water gas production. A process of inestimable benefit to the petroleum industry has therefore involved a most serious loss to the gas industry—a loss which will become more pronounced as the amount of oil cracked and the percentage gasoline yields become greater.

A minor evil resulting from this process is the practice of disposing of cracking residues by incorporating them in gas oil and other fractions. These residues are of a viscous resinous nature, and though normally soluble in the oil, may cause serious blockages in mains by settling out in cold weather.

The gas engineer, however, has, normally, little jurisdiction over the pre-treatment of the oil he is buying, and a more important matter to him is the investigation of its value to him *per se;* this demands a knowledge of its constituents and of their probable behaviour in the carburettor. Since gas oil is such a complex mixture of organic compounds, it would be pointless and indeed impossible to effect a complete analysis, and an assay should, preferably, aim at segregating the constituents according to their cracking potentialities. Workers have for many years concentrated on methods in this connection.

Apart from small amounts of sulphur containing bodies and traces of organic acids, the compounds present in the oil are composed solely of carbon and hydrogen. These compounds can be classified according to four of the major organic groups —viz., paraffins, olefines, naphthenes, and aromatics—and it has been found that these groups each influence in a different manner the enriching value of the oil as a whole. Laboratory methods for the analysis of gas oils along these lines have culminated in the work of Griffith[1] who has evolved a sound routine method which has paved the way to an infinitely better understanding of the carburetting process, in that our raw material is no longer a relatively unknown quantity. Reference should be made to the original paper for particulars of the method. The groups under consideration are well known, and it is necessary here merely to recall that members of the paraffin and olefine series have a molecular structure in which carbon atoms are united in an "open chain," while in the case of the naphthenes and aromatics, the carbon atoms are united in a "closed ring."

Theoretical considerations of cracking are far from conclusive, but their indications, which are substantiated in practice, are that paraffins are the principal gas-yielding constituents of gas oil, and crack profitably with little loss in the form of tar; that olefines are good, but produce more tar; that naphthenes and aromatics are responsible largely for tar formation, producing little gas; and, generally, that the bulk of the gas production is due to the "open chain" compounds. These facts are borne out in a striking way by the recent investigation of oil cracking by Griffith[2], who shows that the dominating factor in an oil's enriching power is its content of "open chain" bodies. His experimental results indicate the rapid reduction in thermal yield as the paraffin and olefine content of the oil decrease. The matter is further evidenced by results from the author's works for three consecutive half-years, over which periods the operating conditions were similar.

TABLE II.

Half-Year Ended	June, 1928.	Dec., 1928.	June, 1929.
P.Ct. chain c.pds. in oil	59·0	61·6	57·1
Therms per gall. obtained . . .	1·26	1·30	1·21
Galls. oil per 1000 c.ft.	1·88	1·87	1·97

In Table III. analyses are given of gas oils which otherwise conform to the normal specifications for distillation, gravity,

&c., and afford some idea of the possible variations in composition.

TABLE III.

Oil.	(1) Paraffins.	(2) Olefines.	(3) Naphthenes	(4) Aromatics.	(1 + 2) Open Chains.
Author's works, 1925	58·5	8·0	15·5	18·0	66·5
" " 1929	52·1	5·0	22·4	20·5	57·1
Good "straight-run"	67·9	6·8	7·7	18·6	74·7
Poor "	36·8	8·8	37·5	16·9	45·6
Pre-cracked . . .	42·6	4·8	17·9	35·7	47·4

Of the first two oils, records show that in 1925 better results than the present-day ones were obtained with lower temperatures and much less need for constant supervision. The other three analyses indicate the range of oil types to be expected at the present time; when a "good normal" oil probably contains 60 to 65 p.ct. chain compounds.

Though this work on the evaluation of gas oils was begun thirty years ago by Haber, Ross, and Leather, and others, it is only recently that it has come sufficiently near to completion to have an application in normal works routine. The chemist has now in his hands a most effective method for the assay of incoming oils, and the importance and instructiveness of regular testing on these lines cannot be over-estimated.

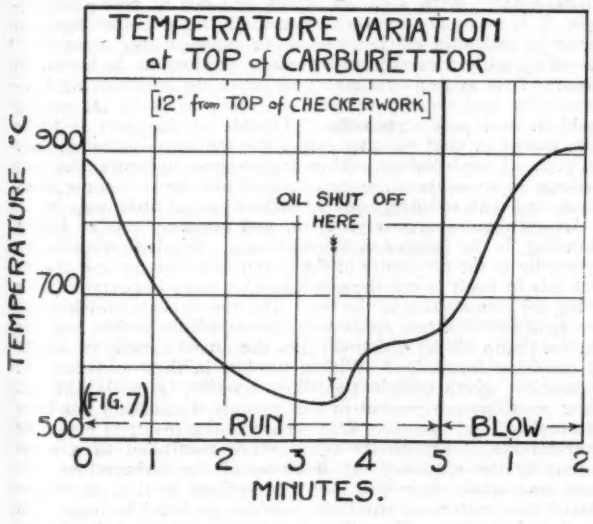
CARBURETTING PRACTICE.

Whatever the gas oil available, the efficiency of its utilization is affected enormously by the methods adopted in its carburetting. Obviously, the first essential is suitable plant, and this will be referred to later, but with a given plant there are five factors which influence the effectiveness of the cracking. These factors are all inter-related, a change in one necessitating alteration in possibly several of the others, but for the sake of clarity they will be considered separately.

(1) *The Cracking Temperature* is of predominating importance. The normal range of operation is 700° to 800° C., and for any particular oil within this range there is a specific temperature at which, making due allowance for other relevant factors, an optimum gas yield is obtained; above this temperature excessive lamp black formation results; below it tar formation increases.

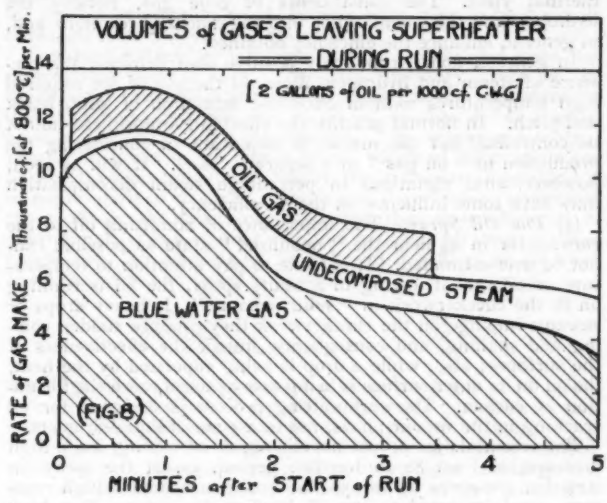
It seems that fairly high temperatures are necessary when using oils of low "open chain" content, and this accounts for the temperatures in general use since the advent of pre-cracked gas oils. It has been the author's experience that to obtain the maximum thermal yield when making a gas of 480 to 500 B.Th.U. in a normal plant, and using an oil of 60 p.ct. chain compounds, a temperature in the region of 800° C. is necessary.

An important aspect of this question is the distribution of temperature in the checkered vessels, and modern opinion inclines strongly to the need for keeping the top of the carburettor as hot as possible, the average temperature here being never below that in the superheater. The temperature fluctuation at this point is great, and this is shown in fig. 7; but



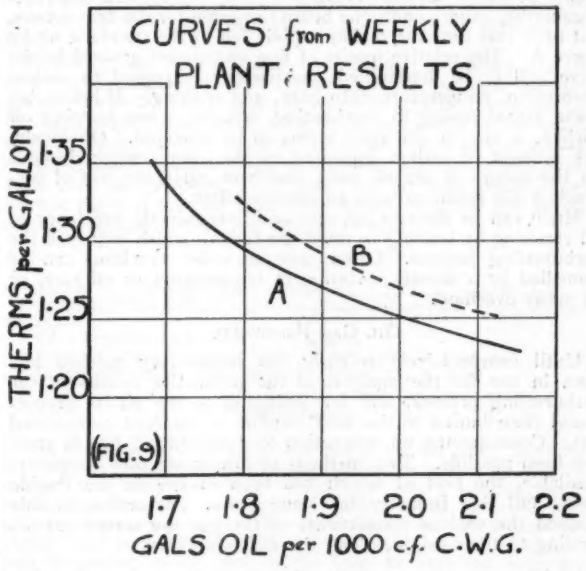
possibly the bricks do not change temperature to quite the same extent as does a thermo-couple when a graph of this sort is prepared.

(2) *The Time of Contact* between the oil vapours and the checkerwork affects the efficiency of carburetting, and is complementary to the temperature. As is the case with many chemical reactions, high temperature can be nullified by short time of contact, and the reverse. This effect, however, is smaller than is generally supposed, and in any case the actual number of seconds contact is in practice governed by the dimensions of the vessels and the volume of blue gas leaving the generator. Variation in the rate of oil input has little effect on the time of contact as is shown in fig. 8, where the output curves for a set making approximately 10,000 c.ft. of 500 B.Th.U. gas per run are given; it will be seen that the oil gas makes a very small addition to the volume of blue gas and



undecomposed steam passing through the vessels, and therefore that variations in the oil rate affect the time of contact to a negligible extent. In the case of two sets at the author's works, the times elapsing between oil admission and the appearance of fog at the superheater offtakes are 5½ secs. and 9 secs. respectively when using the same rate of oil input; no difference in the carburetting efficiencies of the two sets has, however, been found.

The author suggests that a more important factor in this connection is "effectiveness of contact," and this does depend on the actual rate of oil input. The greater the rate, the more dense is the oil fog in the checker spaces, and the less extensively does any one particle come into contact with the hot refractories. The rate of oil input, therefore, limits the efficiency obtainable with otherwise suitable conditions, and in practice this is the factor which governs the results to be expected; efficiencies should always be considered in relation to this, and plant results cannot be compared if the oil inputs are appreciably different. The author has made a practice of examining his plant results in the light of curve (A) in fig. 9.



The weekly results when plotted against the amount of oil used originally gave this mean curve, which was used as a criterion, subsequent results being described as good or bad according as they fell above or below this curve.

Effectiveness of contact and temperature are complementary, and it is sometimes profitable to use a sliding scale of temperatures to suit variations in oil rate, as was used by the author.

TABLE IV.

Gallons Oil per Run.	Equivalent Galls. per 1000 C.Ft.	Temperature.
Above 14	Above 2·3	820° C.
8 to 14	1·3 to 2·3	790° C.
Below 8	Below 1·3	770° C.

Such a scale, of course, can only be determined experimentally on the plant in question.

(3) *Atmosphere,* that is, the nature of the gases which are present along with the oil vapours, has a large bearing on the thermal yield. The constituents of blue gas, notably the hydrogen and the steam, enter into the cracking reactions and, in general, enhance the efficiency obtained.

In general, apart from more positive contributions, the presence of steam and hydrogen allows of the use of the required high temperatures without excessive formation of lamp black and pitch. In normal practice the effects of atmosphere cannot be controlled, but the matter is important in considering the production of " oil gas " in a separate vessel. It will be seen, however, that variations in percentage steam decomposition may have some influence on the oil efficiency.

(4) *The Oil Spray.*—The importance of admitting oil to the carburettor in as near the " nebulized " state as possible cannot be over-estimated. It is futile to pay attention to temperature or oil rate if, owing to a faulty spray, the oil is running on to the checkerwork in " solid streams." If heavy drops or streams impinge on the checkerwork they produce sudden cooling and spalling, and consequently impair the effectiveness of the surfaces; also, while a drop is being vaporized by the heat, the oil on its outer surface is being over-cracked, with the formation of carbon. The carburetting process is designed for oil cracking in the vapour phase, not in a state of liquid droplets.

The essentials for proper nebulizing, or atomizing, are a high pressure, at least 80 to 100 lbs. per sq. in. at the spray (in America pressures up to 250 lbs. are in use) and a high rotatory speed imparted to the oil leaving the spray. This high rotatory speed is only to be produced by arranging for a maximum possible velocity of oil through the necessary spiral holes or slots. Many variable sprays fail in this respect as they are only adjustable at the expense of this " slot speed."

Every attention should be paid to the condition and adjustment of oil sprays. If a spray is working properly, it should be impossible by looking down through the top carburettor sight cock to ascertain whether or not oil is being admitted. The checkerwork should appear bright red and free from dark patches, and should be only slightly dulled at the end of the run, while no sign of fog or droplets should be found.

(5) *The State of the Checkerwork* is known greatly to affect the oil efficiency, but the reason for this is not clearly understood. Undoubtedly catalysis plays a part, as does the rate at which heat is conducted from the interior of the brick to maintain the temperature of the surface. Checkerwork, when new, cracks more efficiently than when old and impregnated with carbon. (The capacity of firebrick for absorbing carbon is surprisingly great, and one used brick was found to contain 20 p.ct. of " combustible matter.") Referring again to fig. 9, curve B was obtained during the first two months after recheckering, other conditions being the same for the two curves, but after this time the results rapidly fell to the standard set by curve A. The relative merits of fine and coarse grained bricks have still to be determined, particularly in regard to carbon absorption, temperature diffusivity, and spalling. If bricks become glazed owing to overheating, possibly when burning off carbon, a loss in efficiency seems to be observed. Obviously, the amount of carbon deposited on the checkerwork depends on the nature of the oil used, and here again the use of pre-cracked oils seems to have an adverse effect.

Much can be done to increase and maintain the efficiency of oil cracking by bearing in mind the factors which influence the carburetting process. Often over or under cracking can be remedied by a drastic variation in temperature or oil rate, or by spray overhaul.

Oil Gas Produced.

Until comparatively recently, no satisfactory method has been in use for the analysis of the productive results of the carburetting process, and for assigning to the oil its proportional contribution to the heat content of the final carburetted gas. Consequently no conception of " efficiency " has in practice been possible. Two methods of attack are now, however, available, the first of which has been in use in the Pacific Coast Oil Gas Industry for some years. According to this method the various constituents of the gas are sorted out according to their origin, along the following lines:

(*a*) The oxygen present is all derived from air which has entered the gas in various ways. This is associated with four times its volume of nitrogen.

(*b*) The remaining nitrogen in the gas is derived from blast products introduced mainly by " blowing over." This nitrogen must originally have been associated with an amount of CO_2 corresponding to the stack gas analysis at the end of the blow. The ratio of $N_2 : CO_2$ in this gas can be determined experimentally, but usually departs little from the ratio 5 : 1.

(*c*) The remaining CO_2 and CO must have been present in the original blue gas, as neither is absorbed or evolved appreciably in the cracking reactions. The hydrogen derived from the blue gas, and associated with these can be shown by a study of the water gas reactions to be equal in volume to $(CO_2 + 2\,CO)$.

(*d*) Some CH_4 is produced from the coke in the generator, and this is assumed to be equal to 0·5 p.ct. of the carburetted water gas.

(*e*) The remaining hydrogen and methane, and all the hydrocarbons C_nH_m, must have been produced solely by the cracking of oil, and, by assigning normal calorific values to them, the total thermal yield from the oil can be determined.

The errors of assumption in this method are small, and, in addition to its main application in calculating efficiency, it gives a most lucid conception of the relative contributions of blue gas, oil gas, stack gas, and air to the final product. By its use the real reason for such troubles as abnormally high inerts can be easily located.

Efficiencies obtained in these ways place a completely different outlook on carburetting work, as from them it is possible really to gauge the effects on the one hand of varying type of oil, and on the other of alterations in operating conditions. The actual efficiency so calculated varies with the amount of oil used, but it would appear to range from 1·2 to 1·4 therms per gallon in good practice.

Oil Tar Produced.

The tar produced by the cracking reactions can also be considered as a mixture of certain specific organic groups, except that the viscous residue left after distilling to 360° C. must be characterized generically as " pitch." As is to be expected, the distribution of the groups is very different from what it was in the original oil; paraffins and naphthenes being practically absent, olefines greatly increased, and aromatics trebled. In Table V., analyses of three tars are given, and refer to the production of a 460-500 B.Th.U. gas.

TABLE V.

Tar.		A.	B.	C.
Free C., grms. per 100 grms. tar .		0·3	0·2	1·0
Naphthalene, grms. per 100 c.c. tar		25·0	20·0	40·0
Paraffins .	P.ct. by volume of total tar	0·2	3·0	Trace
Olefines .		9·0	13·0	8·0
Aromatics		69·0	66·0	63·0
Pitch . .		22·0	18·0	29·0

Such analyses furnish an excellent guide to the effectiveness or otherwise of the cracking. Tar A is of good composition; paraffins and free carbon are relatively low, and the cracking has therefore been so effective that little gas yielding compounds are left in the tar. Tar B has such a high paraffin content that evidently something was radically wrong with the temperature, checkerwork, spray, or rate of input. Tar C is an over-cracked product with a high content of free carbon and naphthalene. By examining tars analytically in this way, much information can be gained supplementary to the actual thermal yield.

Naphthalene is a most undesirable substance in tar, as it produces setting at low temperature, but its presence is often unavoidable. With high oil inputs and oils of poor composition, it is necessary to work abnormally high temperatures in order to maintain efficiency, and, in consequence, some over-cracking with excessive naphthalene production is bound to occur. It is at times necessary to lower the carburetting temperatures, and thereby sacrifice efficiency to avoid tar setting solid in seal pots and mains. Trouble of this sort is to be anticipated in cold weather when the tar contains much over 30 p.ct. of naphthalene. This naphthalene nuisance also has become more acute since pre-cracked oils have become common, and with existing apparatus there seems little remedy.

An even more urgent problem, and certainly one of longer standing, is the formation of emulsions. Emulsification is due primarily to the proximity of the gravities of the tar and water; but this in itself is not the sole cause, a more important factor being the composition of the tar. The constituents which make for emulsification are, apparently, the paraffinic bodies, and free carbon (lamp black) which supplies the nuclei usually necessary to emulsion formation. With a tar low in these constituents, separation, given sufficient settling capacity, is rarely difficult. Now paraffins are present in the tar only if cracking has been incomplete, and excessive free carbon is the result of extensive over-cracking. Emulsivity is therefore controlled to a great extent by the efficiency or otherwise of the carburetting process, and while there are many exceptions to this, it can be stated that minimum emulsion troubles go hand in hand with good carburetting. Here then is an extremely useful guide to correctness of operating conditions.

In investigating the working of a plant, therefore, attention can profitably be paid to the nature and composition of the tar produced.

Carburetting Plant.

Though there has been little basic alteration in the arrangements for enriching the generator gas since the earliest plants of any importance were built, there has been a tendency to reduce the actual size of the checkered vessels, and there now seems considerable doubt as to the advantage of this reduction. Water gas sets built thirty years ago included carburettors and

superheaters of the same size as are now attached to sets of twice their capacity. Admittedly, these plants were designed for high oil inputs; for these inputs they were probably too small, as the efficiencies obtained were not good, in spite of the fact that the oils in use were far superior to present-day ones. These earlier sets, however, give consistently higher efficiencies, except at very low oil rates, than do modern ones. As an example of this, the total cracking surface in one set installed in 1898 to produce ¾ million c.ft. a day is almost identical with that in a modern 2 million set; by reason of this it is found that while 500 B.Th.U. gas can be made in the older set (which now produces 1 million c.ft. a day) with a yield of 1·25 to 1·3 therms per gallon, such an efficiency can be maintained in the modern set only when making gas of 400 to 430 B.Th.U. The saving in capital cost effected by decreasing the size of the vessels appears, therefore, to be doubtful economy, in that a permanent loss of efficiency results if a gas of over 400 B.Th.U. is made. Here again the introduction of poor oils which are more difficult to gasify has increased the need for as large a cracking surface as possible, and has added a further argument in favour of reversion to the older standards.

Possibly the most important recent development in carburetting plant is in the reducing and partial elimination of checker-work. In America, heavy oils are being used to a considerable extent, and they bring in their train troubles from abnormal deposition of carbon. It has been found that while good carburetting results are obtainable with these oils, the checkerwork rapidly becomes blocked. To overcome this the checker spacing was at first increased, and while some improvement was effected, it was found in 1920 that much is to be gained by adopting a completely empty carburettor. Good results are obtained by applying this "checkerless carburettor" system to the cracking of ordinary gas oils, providing complete "nebulizing" is effected by the spray, and there seem good reasons to anticipate its more general adoption. Briefly the advantages are as follows:

(*a*) All carbon and "fliers" fall to the bottom of the carburettor instead of being deposited so as to foul the checker bricks and block the gas-ways.

(*b*) More uniform cracking conditions are obtained throughout the period between overhauls. There is no checkerwork in the carburettor to cause gradual loss of efficiency.

(*c*) Lower cost of re-checkering, as only the superheater is concerned, and a greatly increased life is obtained.

(*d*) The set output is never diminished owing to back-pressure in the vessels.

When this system is applied to ordinary gas oils, the main advantage, and one worthy of attention, is that the oil is completely vaporized in the carburettor and enters the superheater checkerwork in this state, whereby the possibilities of efficient cracking are enhanced. Somewhat larger vessels are required, as the superheater checkerwork is usually so augmented as to produce a total reduction in cracking surface of not more than 25 p.ct. Modifications of this system are carburettors of the "pier filled" type, in which the normal checkerwork is replaced by one or more walls or piers on to which the oil is sprayed.

With all these variations from normal methods, oils of up to 15 p.ct. coke content have been used successfully, means being adopted for frequently cleaning out the bottom of the carburettor.

Much of the falling off in oil efficiency after re-checkering is actually due to the disturbance of the top few courses in the carburettor and a consequent interference with the proper distribution of the oil. The author has overcome this trouble by jointing together with fireclay the bricks in the top three courses, and it is found that when this is done, the free-way is not obstructed after 5000 hours' gas-making.

CONCLUSION.

If any extensive alteration takes place in carburetting practice in the near future, it will probably be in the direction of utilizing inferior oils, rather than in an attempt to obtain a greater efficiency from oils of the present-day type. It is unfortunate that of commercially available oils, petroleum products are the only ones with any considerable enriching potentialities, and that as these decrease in quality there is no adequate alternative. The following oils may play some part in carburetting in the future: "Topped" petroleum crudes, petroleum wax distillates and distillation residues, coal tar creosote, and low-temperature tar oils.

The petroleum products may be considered together. They are thick and viscous, but have been used successfully in conjunction with steam preheaters and checkerless carburettors. The advantage of their use, in addition to their low price, lies in the fact that they are straight-run, and have not been subjected to any cracking processes. With suitable plant, Mexican crudes of coke content 16·9 p.ct., specific gravity 0·98, and 36 p.ct. residue at 345° C., are reported[3] to have been used with an efficiency in the region of 80 p.ct. of that obtained with gas oil. There is, therefore, quite a possibility that such oils may partially replace inferior gas oils.

Before this paper is read, the use of coal tar creosote will have been dealt with at length before the Institution of Gas Engineers. It will suffice here to emphasize that the thermal yields quoted are only one-third to one-half the yields obtained under similar conditions from gas oil. The economic urgency for the use of creosote would consequently have to be great to outweigh such unprofitable gas yields.

Low-temperature tar oils have distinct possibilities from the carburetting point of view. They are "primary" tars and in many ways resemble a partially cracked gas oil; creosote, on the other hand, is more akin to oil tar, in that it has already been subjected to high temperature. By cracking low-temperature tar oils in the liquid phase, yields of light spirit are obtained which apparently justify the commercial production of motor spirit in this way. Davis and Parry[4] have carburetted these oils in the laboratory, and find that their efficiency is approximately 80 p.ct. that obtained with gas oil under similar conditions. An analysis by Morrell and Egloff[5] of an oil freed from tar acids and bases is as follows:

Olefines	65·3
Aromatics	10·1
Paraffins and naphthenes	24·6

The high olefine content augurs a fairly good gas yield. Further work on the use of these oils in water gas manufacture may provide a market for at any rate a portion of them.

Mention should be made here that, though these various mediums give disappointing results by straight cracking, enhanced yields may reasonably be expected by using a judiciously controlled atmosphere in an "oil gas" type of plant.

As alternatives to the use of low-grade enriching agents such as have been described, there should be borne in mind the use of coal as a generator fuel, with an output of correspondingly richer generator gas, also the catalytic methanation of blue gas, which is a process that is by no means beyond the bounds of financial possibility, when allowance is made for the high cost of a therm from low-grade oils.

Should the industry be forced to make general use of any of these poor substitutes for the present system of enrichment, it would be necessary to reconsider seriously the economics of the manufacture of carburetted water gas. From the point of view alone of the disposal of oil tar, which at present commands a very poor market, the matter would be rendered serious by the consequent increase in the yield of this product. The future of carburetted water gas is, therefore, to a great extent dependent on the petroleum world. Gas oil is now a bye-product in the production of gasoline, and everything is done to decrease its bulk. Indeed, a plant is being built for the Standard Oil Company, in New Jersey, for the hydrogenation of heavy oils by methods akin to that of Bergius, and yields approaching 100 p.ct. are anticipated. That is, it will become possible, if desired, completely to eliminate the gas-oil fraction.

Evidently, on account of the enormously increased and increasing demands for motor spirit, the advantages accruing to the "anti-knock" characteristics of cracked spirits, and the relatively limited supplies of crude petroleum in the world, the petroleum industry is doing all in its power to increase the cracking yield at the expense of all other fractions. We in our turn must accept what is left, and that we may use this product in the best possible way, there is vital need for still further research on both works and laboratory scales.

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[3] Proc. American Gas Assoc., 1925, p. 1222.
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Discussion.

The PRESIDENT, in thanking Mr. Grant for his paper, said that it hardly seemed necessary to congratulate the author on the way he had dealt with the subject. The paper was a treatise, and he hoped that those in a less fortunate position would take advantage of the results obtained, and clear up many points which were previously hard to understand. In the first place, said Mr. Larkin, it was interesting to see that as far back as 1875 the waste-heat boiler was introduced in one of the first carburetted water gas plants built. From the mechanical engineer's point of view, the reaction chamber was a very fine piece of work. In regard to the effect of temperature on gas and tar yields, where reference was made to the relatively small temperature variation, could 100° really be called small? The chart in question showed how necessary it was to find the optimum cracking temperature for any particular oil. In the case of the two sets quoted, at Mr. Grant's own works, he had said that the times elapsing between oil admission and the appearance of fog at the superheater offtakes were 5½ secs. and 9 secs. respectively when using the same rate of oil input, while no difference in the carburetting efficiencies of the two sets had been found. This big difference of 5½ and 9 secs. was surely remarkable if there was nothing to account for it. In regard to the question of sprays, the variable spray could be designed in a series of discs, and would be found satisfactory, though efficiency really depended upon the pressure. Also it was usually advisable to alter the rate of oil input.

It was interesting to note that the plant built thirty years ago provided a carburettor and superheater of the same size as those to-day, and these early sets gave higher efficiency. So now they had a carburettor which was doing double the work that it was originally designed to do. In the original plant they must have had a very much larger carburetting surface. It seemed strange that alteration in the checkerwork should give better results. A point to be emphasized was Mr. Grant's statement that when good straight-run gas oils were in use, the highest efficiency was obtained by adopting fairly narrow checker spacing—2½ to 3 in.—and the staggered arrangement, thus ensuring a maximum surface contact, and enabling relatively low temperatures to be used. Finally, he would like to refer to one of the last statements in the paper, and ask what were the advantages accruing to the "anti-knock" characteristics of cracked spirits, and why cracked spirits had these "anti-knock" characteristics.

Importance of the Rate of Oil Feed.

Dr. R. H. Griffith (Gas Light and Coke Company) said that Mr. Grant had shown how the efficiency of cracking varied with the rate of oil feed; and the importance of this point could not be overemphasized. The results did not depend simply on the time the vapours took to pass through the cracking vessels, but on the probability of an individual oil molecule decomposing; and this was directly related to the total amount of oil added to the plant in unit time. The case was not altered whether reaction occurred on a hot surface or in a hot space, and actually there was no doubt that a large proportion of the cracking took place in the vapour phase: This probably accounted for the successful use of checkerless carburettors, where the walls alone had sufficient heat capacity to warm the gases passing through. In practice, of course, there was a limit to the time available for carburetting, and this was particularly important when back-run was operated, because the gains due to saving of coke might be outweighed by loss of oil efficiency. In the other direction, it was possible to over-crack oil by adding it too slowly, but this could always be prevented, as in most existing plants the generator capacity had been increased more than cracking capacity. Poor results due to faulty checker bricks were probably ultimately caused by poor heat transfer to and from the brick rather than by changes in any contact action. The state of the brick surface could not remain the same for any appreciable time, and the nature of the carbon deposited on it depended more on the cycle operated than on carburetting conditions. Sources of enrichment other than petroleum were not easy to find in large amounts, but it was not likely that coal oils would ever become important. Liquid propane and butane were successfully used in America, and were extremely clean to handle; and though no mineral gas was available in England, it was possible that considerable quantities of methane and ethane would be produced as bye-products from synthetic processes.

Probable Increase in Price of Gas Oil.

Dr. S. Pexton (Gas Light and Coke Company) said that Mr. Grant's conclusion that the gas oil of the future would probably be of inferior quality to that supplied at the present day was undoubtedly correct. In addition, it might be predicted that, as other uses for gas oil were found, the price of gas oil would probably increase. The instability of the oil market had probably influenced a number of engineers to instal vertical retorts rather than horizontal retorts and water gas plants. Dr. Pexton said he could not pretend to speak upon the thermal behaviour of gas oil with the authority with which Dr. Griffith had spoken, and would therefore confine himself to more general topics arising out of the paper. The method of analysis of the working results of a carburetted water gas plant might be simplified, and stated more logically without reference to the composition of the blow gas. The total combined and uncombined oxygen present in carburetted water gas was due to two sources—air and steam. The oxygen due to air was approximately one-quarter of the nitrogen content, and if this was deducted from the total combined and uncombined oxygen in the carburetted gas, the resultant oxygen must have been accompanied by twice its volume of hydrogen in the blue water gas. The remainder of the calculation as stated in the paper held good. All these methods of calculating the distribution of thermal yields between coke and oil were dependent upon the assumption that no free hydrogen was derived from the coke. Reference to the Seventh Report of the Gas Investigation Committee showed, however, that the hydrogen content of the blue water gas was 2·6 p.ct. in excess of that calculated in the manner indicated above. This represented nearly 3 p.ct. of the thermal value of the blue water gas made. The net effect of this upon the calculated distribution of therms between coke and oil was to give too low a result for the coke and too high a result for the oil. The errors would increase as the consumption of oil decreased. Though it was impracticable to correct for this error, yet its existence made the results less precise. It was felt that the temperature of the gas at the top of the carburettor was to some extent dependent upon the temperature of the upper part of the fuel bed in the generator, as well as upon the conditions of oil spraying. The primary cause of water in tar emulsions, concluded Dr. Pexton, appeared to be the deposition of the tar from gas which had become almost saturated with water vapour as a result of its passage through the wash box. The readiness with which the emulsions broke was probably controlled by the conditions of storage and, to some extent, by the composition of the tar.

Mr. D. C. Cross (Lea Bridge) said he would like to congratulate Mr. Grant on the quality of his paper on a question such as this. Those who were less fortunate had to rely on obtaining their information from those experts who had specialized on the subject. A large Company such as the Gas Light and Coke Company, who tested their oil continuously as it came in, could follow the open chain process. He had never realized before how it affected them. He then went on to refer to some tests on the oil received at his works in the last four years. He would like to know where Mr. Grant took his temperature of 800° C. That was equal to 1475° Fahr., whereas in most water gas plants Mr. Cross had seen, the temperature was not much over 1425°. The temperature of 1475° was extraordinarily high unless it was taken right at the top of the carburettor, whereas most pyrometers were at the bottom. He had come across a works this summer which were trying to obtain higher efficiency at an increased temperature. But they immediately increased their naphthalene troubles and had to put a washer on the plant. This was one way of meeting the trouble. He had tried to put up the temperature by 25° Fahr. in order to obtain higher efficiency, but naphthalene troubles arose at once, and they had not got over them yet. In this case he only raised the temperature to 1425°, but it created tremendous troubles, though they did obtain a higher oil efficiency. Cases such as these went to prove how careful one had to be when experimenting along these lines. Mr. Grant had mentioned tar emulsions. They had got over this difficulty at Lea Bridge by taking tar down to the bottom of the relief holder, where it was subjected to pressure, and drawing it from there as and when required for selling purposes. They had been fortunate in being able to sell tar containing under ½ p.ct. water. He had always put the efficiency of his cracked oils down to the relief holder. The pressure injection methods were a revelation—particularly the 250 lbs. pressure mentioned in the paper. The Humphreys & Glasgow spray was recommended to be used at only 25 lbs. per sq. in., but they had tried it at 100 lbs. pressure, and the result was that tar fog found its way into the blast valve. But the use of 100 lbs. pressure was unique, and was certainly worth further investigation. He would say that, to get the pressure of 100 lbs., it would be necessary to change the size of the disc according to the amount of oil used. The higher the pressure, the greater the efficiency.

Mr. L. Lacey (Gas Light and Coke Company) thought that the paper they had just heard was one of outstanding value to the Association. The last paper they had had on this subject was by Mr. Stewart many years ago, which dealt with the important question of waste-heat recovery. Mr. Grant was fortunate in being in a position to furnish such very useful practical details as to the work of oil gas carburettors. Mr. Grant's references were to some extent to American practice, but he was sure that very much higher pressures would be worked in this country. The author had made a reference to the question of preheating the oil. It was Mr. Lacey's experience that this had been given up. He would like to know whether preheating was now considered a point worthy of attention.

Mr. R. Summerson (Luton) said that that afternoon a paper had been read before the Southern Association of Gas Engineers and Managers on the complete gasification plant at Mill Hill, and this would make very interesting reading in conjunction with what they had just heard from Mr. Grant.

Carburettor a Heat Storer.

Mr. W. J. R. Waterfield (Gas Light and Coke Company) remarked that, in the light of recent experience both in the laboratory and in large-scale working, it would appear that the carburettor was really a heat storer, and 100° difference in the carburettor temperature made considerable difference in the thermal yield; at the beginning they might have the right temperature in the spray, and at the end 100° lower. Very heavy oils formed excessive deposits when undercracked, and this was the reason why a great deal of the oil used to-day was giving much better efficiency than heavy oils. Mr. Waterfield said that he himself had had some experience of getting oil down the up-run pipe; but by increasing the pressure on the spray, a better spraying angle could be obtained. They altered the checkerwork so that the oil impinged upon it in a thin circle.

Mr. W. T. Kenshole (Lea Bridge) agreed with Mr. Cross that there was great variation in the quality of gas oil. He stated how frequently they had to remove carbon from the checkerwork. He asked what section of brick the author was using, and, if he had employed any other, which was preferable.

Mr. T. H. Prater (Margate) said that it was ten years since they had a paper on this aspect of the carburetting process and the cracking of oils. Investigators were to-day paying more and more attention to the degree of hydrogenation taking place at normal carburetting temperatures, and a better type of thermo-couple had been devised. In the past, one had been accustomed to look upon the part of the plant where vaporization took place as rather important. The work of Griffith had been referred to; and it should be made clear that this method of analysis was timed to take only 24 hours, and could easily be carried out in any gas-works laboratory. Mr. Grant had mentioned that over 30 p.ct. of the United States gasoline was now a product of the cracking process. This should be of interest to motorists. The particular advantage of the cracked oils was the higher compression obtained in internal combustion engines. In America there was a difference of 2 cents per gallon in the price of cracked oils and straight-run.

Mr. J. H. Goldsmith (South Suburban) asked Mr. Grant if he could enlighten them upon the use of naphthalene oil, and whether he had had any experience of naphthalene oil for carburetting.

The Author's Reply.

Mr. Grant, in replying to some of the points raised in the discussion, said, in reference to the President's remarks about the waste-heat boiler installed in 1875, that the boiler was never intended to have to stand up to such conditions. The Cross process was introduced before any other firm was making reaction chambers of that kind. In regard to the variation referred to in temperature, he considered that 100° was not a small variation; even 20° had an appreciable effect on the thermal yield obtained. In connection with the variable spray, the important point was the pressure. The higher the pressure on the top of the disc, the greater the speed of the oil through the spiral slots. It was essential to get a maximum pressure at the spray itself (not at the pump). He would like to thank Dr. Griffith for what he said. In reply to Mr. Cross, he stated that the temperature was taken at the top of the carburettor.

In the particular graph referred to, the temperature was taken in the carburettor brickwork. The undecomposed steam was periodically calculated. The temperature of 800° was taken at the base of the superheater. That temperature allowed of a fairly high oil rate—1·8 gallons per 1000 c.ft. The temperature must be stated in connection with the oil rate, for a lower rate of input in this case would have required a lower temperature. The 250 lbs. pressure at the spray was admittedly practised largely in America. In regard to the question of preheating, Mr. Grant said that the amount of steam used should be very small. Referring to the matter of burning-off the carbon, it was not general practice, and they therefore did not do it at his works. It was better to use gas tubing as a sheath for the pyrometer, and frequently renew it. In reply to Mr. Kenshole's question as to what type of brick they used, Mr. Grant observed that it was a fairly porous firebrick. He was in full agreewith the Griffith method of analysis in application to small laboratories. In regard to what he had said in the paper about over 30 p.ct. of the United States gasoline being now a product of the cracking process, this was the figure for 1927. At the World Power Conference, a figure of 31 to 32 p.ct. was quoted.

VOTE OF THANKS.

A vote of thanks to Mr. Grant for his paper was carried on the proposition of Mr. T. H. PRATER (Margate), Senior Vice-President, seconded by Mr. J. H. GOLDSMITH (South Suburban), Junior Vice-President.

ECONOMICS OF BENZOLE RECOVERY AT GAS-WORKS.

By F. FIRTH, Chief Chemist to the Leeds Gas Department.

This constitutes one section of Mr. Firth's Presidential Address to the Yorkshire Junior Gas Association. We hope to publish further sections later.

I propose to discuss a subject which, in my opinion, appears to have escaped the attention it merits. It is my intention to deal fully with the various factors, connected with the manufacture and disposal of gas, which influence the economics of benzole recovery. It is desirable, perhaps, at the outset to dispose of two "bogies" frequently assumed to be a necessary evil of benzole recovery—viz., increase of naphthalene troubles and drying of meter leathers.

Naphthalene troubles are always possible on the district unless the naphthalene is removed completely from the gas. When means are adopted to carry this out—either by washing or spraying—the installation of a benzole recovery plant is an advantage. The naphthalene is partially removed in the benzole scrubbers, which thus share with the other plant the burden of naphthalene removal. Drying of meter leathers is a figurative term. Actually, it refers to a condition caused by the "oil dressing" draining from the meter leathers. This draining is a result of the absorption of the light oil from the gas. It is obvious that a gas denuded of its light oils could not act in this manner. The actual drying of the oil used for meter leather dressing is a remote possibility, especially if castor or other fixed oil is used.

We will now consider how the factors enumerated below affect the economic problem of benzole recovery from town gas:

(1) Potential output of the gas-making plant in relation to the demand.

(2) Declared calorific value; methods used to reduce the quality of gases of higher calorific value to meet the statutory calorific value.

(3) Price at which B.Th.U. should be debited to the benzole plant.

POTENTIAL OUTPUT.

Gas undertakings have to make provision for sufficient plant to meet the maximum seasonal demand, and usually it is only necessary to put it into commission on a few isolated occasions during the year. At all other times the plant is more than necessary to meet immediate requirements and some portion is standing idle.

Standing surplus plant always incurs a loss. The comparative savings are confined to the net cost of coal and carbonizing wages, and these are negligible compared with the extra burden of interest and overhead charges put on the working portion of the plant, while the cost of gas into holder is increased. It is obvious that any proposition which will reduce this financial burden of idle plant is for the general well-being of the gas industry, and on these grounds the recovery of benzole from town gas is worthy of very serious consideration.

The possible recovery from town gas is about 5 p.ct. in terms of the thermal yield from the ton of coal carbonized. Considering a 5-million-a-day works with a declared calorific value of 500 B.Th.U. (gross), the potential recovery is equivalent to 250,000 c.ft. a day. Expressed in another way, it means that the installation of a benzole plant on the works automatically creates a "new customer," guaranteeing to take a quarter-of-a-million c.ft. a day; this new customer is very adaptable, and does not demand a regular supply as with the ordinary consumer. In case of a sudden emergency demand—e.g., foggy or frosty weather—this B.Th.U. equivalent of a quarter-of-a-million c.ft. is immediately available for the ordinary supply. Is it possible to imagine a more desirable consumer?

Another factor—less important but nevertheless desirable—is that the benzole plant becomes a customer for boiler fuel required for steam raising and fuel for direct heating. Dr. E. W. Smith,* in a recent paper on the costs of gas production by various systems, brings out vividly the disparity between the cost of gas into holder (assuming the plant is working at full capacity—unfortunately a rare occurrence) compared with the selling price. I suggest that one of the principal reasons is the difference between the potential output of the plant and the actual demand. Any suggestion which will find a new market for B.Th.U.'s, whether as liquid or gaseous, is worthy of careful investigation.

MEETING THE STATUTORY C.V.

"Straight" coal gas made by horizontals, inclined, verticals, &c., has a calorific value of approximately 550 B.Th.U. (gross). Unless the declared calorific value is in this neighbourhood, it will be necessary to dilute with water gas, producer gas, or air. This means that when dilution has to be carried out, the diluent gases are actually being carburetted with benzole. Benzole is worth 1s. 5d. a gallon—a very costly material to use compared with (say) gas oil at 4½d. a gallon. Even when the declared calorific value is in the region of 550 B.Th.U., making dilution unnecessary, the creation of a customer for the equivalent of an additional 5 p.ct. of the gas yield may be sufficiently attractive financially to influence an undertaking to adopt benzole recovery. The declared calorific value would have to be lowered, but the undertaking receives 7·3d. a therm for this extra sale of very substantial dimensions; also no distribution charges are incurred.

In order to illustrate the comparative costs of producing (say) a 500 B.Th.U. (gross) gas by dilution or, alternatively, by benzole recovery, hypothetical tables of the costs of gas into holder by the respective methods are given (Table 1). It will be observed that a definite demand for gas is assumed; I consider this to be the only fair basis for calculating the true comparative costs, because, unfortunately, production in excess of the demand means shutting down plant until the excess is worked off. Thus calculations based on the maximum production give results which seldom agree with those obtained in practice.

THERM COST OF BENZOLE RECOVERY.

It is customary in drawing up a balance-sheet for a benzole recovery plant to debit the plant with the cost of the gaseous therms recovered as benzole at the price of therms into holder. It will be realized, therefore, that, in order to show the best results, using this figure as a basis of charge, a low cost of gas into holder is essential, which means the benzole plant would appear to be giving the best results only when the gas-making plant is working full out. But is this correct?

I have endeavoured to show that the value of a benzole recovery plant to a gas undertaking is that the process is equivalent to a new consumer. A substantial customer is most desirable at that period of the year when the ordinary demand for gas is lowest; incidentally, this coincides with the period when the cost of gas into holder is at a maximum. To differentiate in the cost of therms to the benzole plant more favourably to winter working than to summer working obviously is not sound. It is not practised on the ordinary consumer; in fact, it would not be tolerated.

I suggest, therefore, that the value of a recovery plant to a gas undertaking can be accurately assessed by calculating the financial return per therm of gas recovered by the plant, after

* "A Study of Comparative Costs on Gas Production in the Retort House," presented at Second International Conference on Bituminous Coal, Carnegie Institute, Pittsburgh. See "GAS JOURNAL," Vol. 184, p. 845.

COST SHEET. (*For One Month's Working.*)

"Hypothetical" case. Requirement—to produce 155 million c.ft. at 500 B.Th.U. (gross).
Calorific value of "straight" coal gas . 522·8 B.Th.U. (gross).
Make per ton of coal . . . . . 72 therms = 13,775 c.ft. at 522·8 B.Th.U. (gross).
Net cost of coal . . . . . 8s. 5·016d. per ton.

Calorific Value Reduced by Benzole Recovery.	Calorific Value Reduced by Dilution with Producer Gas.	Calorific Value Reduced by Dilution with Water Gas (Blue).	Calorific Value Reduced by Dilution with Air.
Quantities necessary— 156,100,000 c.ft. at 522·8 B.Th.U. with benzole recovery will give 155,000,000 c.ft. at 500 B.Th.U. 2·308 galls. recovered per ton.	Quantities necessary— 146,500,000 c.ft. at 522·8 B.Th.U. 8,500,000 c.ft. producer gas at 107 B.Th.U. 155,000,000	Quantities necessary— 139,120,000 c.ft. at 522·8 B.Th.U. 15,880,000 c.ft. water gas at 300 B.Th.U. 155,000,000	Quantities necessary— 148,250,000 c.ft. at 522·8 B.Th.U. 6,750,000 c.ft. air 155,000,000
Coal used— $\frac{156,100,000}{13,775}$ = 11,333 tons	Coal used— $\frac{146,500,000}{13,775}$ = 10,635 tons	Coal used— $\frac{139,120,000}{13,775}$ = 10,098 tons	Coal used— $\frac{148,250,000}{13,775}$ = 10,763 tons
Cost of Coal— £ 11,333 at 8s. 5·016d. . 4770·2 *Deduct*— £ Benzole recovered— 11,333 × 2·308 = 26,160 galls. at 1s. 5d. per gall. . . . 1853·0 *Less* working expenses at 6d. per gall. . 654·8 1198·2 £3572·0	Cost of Coal— £ 10,635 at 8s. 5·016d. . 4476·5 Coke used— $\frac{8,500,000}{170,000}$ = 50 tons at 17s. 7·22d. per ton . 44·0 £4520·5	Cost of Coal— £ 10,098 at 8s. 5·016d. . 4250·0 Coke used— $\frac{15,880,000}{50,000}$ = 317·6 tons at 17s. 7·22d. per ton 279·6 Steam— 30 lbs. per 1000 c.ft. at 1s. 8d. per 1000 lbs. . 39·7 £4569·3	Cost of Coal— £ 10,763 at 8s. 5·016d. . 4530·0 Air— Cost—*Nil* £4530·0

NOTE.—Cost of coal and coke are the averages for 1928—taken from "Field's Analysis."
Calorific value of recovered benzole taken as 156.000 B.Th.U. per gallon.
Labour, overhead and capital charges, &c., are included in the cost of benzole recovery, but are not included elsewhere. It has been assumed that the difference in the other items under this heading would not materially influence the comparative results.

1235 tons of extra coal have been carbonized when the C.V. of the gas was adjusted by benzole recovery as against dilution with water gas. This only affects wages for carbonization which are given by Dr. E. W. Smith at 0·13d. per therm or thereabouts—9·36d. per ton. The extra cost involved, therefore, will be 1235 times 9·36 minus 240 = £48·17, which is not sufficient materially to affect the comparison.

To be fair, costs should be calculated for water gas and producer gas production, but the figures obtained are not applicable. Consequently, in drawing up the cost sheet, it was confined to materials only.

making the necessary deductions for working expenses, &c.—e.g.,

	s.	d.
Gross price received for benzole, per gallon . . .	1	5
Cost of production, per gallon	0	6
Net price received for benzole, per gallon	0	11

Equivalent to 7·3d. per therm, or 3s. 0½d. per 1000 c ft. (500 B.Th.U. gross).

Using my previous example of a 5-million-a-day works, this would mean a guaranteed daily consumption of a quarter-of-a-million c.ft.

Benzole plant returns for our own undertaking, based on a full year's working—ended March 31, 1929—are very interesting, and provide practical proof of the reasoning set out above.

Declared calorific value—470 B.Th.U. (gross).
Benzole recovered expressed in terms of cubic feet (470 B.Th.U.).
Per annum . . . . . 66,760,000 c.ft.
Per quarter . . . . . 16,690,000 ,,
Working expenses (including everything) . 5·91d. per gallon

After deduction of working expenses, the price realized is equivalent to 3s. 3d. per 1000 c.ft. (8·30d. a therm), and, as I have pointed out before, there are no distribution charges as in the case of the ordinary consumer.

The price of gas in Leeds to a consumer having a maximum quarterly consumption of 5,500,000 c.ft. is 2s. 3d. per 1000 c.ft. Our benzole plant consumes the equivalent of 16,690,000 c.ft. a quarter, and pays a price equal to 3s. 3d. a thousand. Is not the proposition for benzole recovery worthy of serious consideration? I have already expressed the opinion that the value of a benzole recovery plant should be judged on the financial return for the therms removed from the gas. It is of interest to examine, on this basis, the financial benefits being lost by undertakings which can supply gas profitably at a very low price—e.g., a large undertaking supplying gas at 1s. 6d. per 1000 c.ft. to big consumers:

Annual make 2900 million (500 B.Th.U.) c.ft.

Additional sales, if benzole recovery was adopted, would be equivalent to 145 million c.ft. per annum, giving a net cash return (after deducting all benzole plant expenses) of £22,000.

An existing consumer for a similar amount of gas gives a net cash return of £10,875.

Comment is unnecessary.

Certain undertakings are buying coke oven gas at round about 6d. to 8d. per 1000 c.ft. Benzole has an immediate sale at a price equivalent to about 3s. per 1000 c.ft. (the exact price is determined by the declared calorific value). Why leave this in the gas when it could be replaced at 8d. per 1000 c.ft.?

Before leaving this subject I must show you how the economics of benzole appear to have been surveyed and then shelved as being unprofitable. The process of analysis has generally taken this form:

Benzole contains 1·5 therms (approx.) per gallon.

	s.	d.
Value of a gallon of benzole . . . . . =	1	5
If sold as gas at 9d. per therm . . . . . =	1	1½
Difference	0	3½

This difference of 3½d. has to meet all plant charges, &c., which are usually somewhere in the neighbourhood of 6d. a gallon. Therefore, a loss of 2½d. would be incurred on every gallon of benzole produced.

This reasoning is fallacious because:

(*a*) It assumes that if benzole is not recovered, the equivalent therms have an immediate sale as gas. But therms produced in excess of the normal demand are put into storage; benzole recovery means an additional customer.

(*b*) It demands that a customer, taking 5 p.ct. of the total therm output, without entailing any distribution, maintenance charges, &c., shall pay on the highest scale of gas charges.

This is unreasonable and in direct contradiction to the usual established practice.

Now let us reverse the process of reasoning. First, fix the benzole plant charges (approximately 6d. a gallon), and then deduct these from the selling price per gallon of benzole. The result gives the price realized for 1½ therms (approximately), and, as I have shown previously, this is in the region of 7d. to 8d. per therm. Such a figure will usually compare very favourably with the price charged to big consumers.

The first principle of any business is to sell your commodity, and not to miss sales by demanding unreasonable profits. The essence of our business is to sell therms, and the question of form must not hamper our activities.

YORKSHIRE JUNIOR GAS ASSOCIATION.

Visit to the Meadow Lane Gas-Works, Leeds.

The members of the Yorkshire Junior Gas Association met on Saturday, Nov. 16, at the Meadow Lane Gas-Works, Leeds, to hear the Presidential Address by Mr. F. Firth, Chief Chemist to the Leeds Gas Department. Mr. J. W. HORWILL, of Bradford, Senior Vice-President, presided.

During the afternoon the visitors inspected the works, which they found particularly interesting by reason of the recent erection of a new installation of West's 50-in. vertical retorts, which had been working only a fortnight, and had not yet actually been formally inaugurated. It is an installation of 30 retorts, of 3 million c.ft. capacity per diem.

The Leeds Gas Department's chief laboratories are situated at the Meadow Lane Works, and the members of the Association were enabled to make a detailed inspection of these, with whose working the new President is primarily connected. The layout of the laboratories comprises preparation room—with

THE PRESIDENT,

Mr. F. Firth, Chief Chemist to the Leeds Corporation Gas Department.

grinder, emery wheels, 6-in. Drummond lathe, air compressors (all of which are power-driven), metal planer, hand vacuum pump, and glass-blowing bench. The laboratory proper is well equipped with separate working benches for each chemist, and fitted with high and low pressure gas, air pressure and vacuum, three fume cupboards, a large stone working bench with canopy connected to the main flue, and general chemical and physical apparatus, together with special instruments for industrial testing; also with a balance room and library, photographic dark room, and store. There is a coal testing plant which is in itself a complete unit, carbonizing one-hundredth of a ton, and all coals used on the works are tested on this plant.

The party were greatly interested in the Fairweather recording calorimeter, as prescribed by the Gas Referees. Mr. J. Firth, Gas Examiner, was present to explain the instrument. Special interest was taken in the research laboratory and apparatus (also at Meadow Lane Works) used by Mr. J. W. Wood, M.Sc., A.I.C., of Leeds University, Research Chemist to the Joint Research Committee of the Institution of Gas Engineers and the University of Leeds.

The visitors were then taken to the museum at Meadow Lane. This contains a remarkable collection of representative appliances for lighting, heating, cooking, and other purposes, showing the development of apparatus from the old days when the supply was furnished by the Leeds Gas Light Company. The museum illustrates particularly the evolution of lighting appliances.

In here, also, there was a large scale model of the new meter shops in Bridge Street, which are to be opened shortly. The visitors were also shown a very comprehensive display of temporary repairs to gas appliances, piping, joints, &c., as effected by the defective methods of unauthorized persons as a supposed "economy," which had been found by the Department's fitters on consumers' premises, and appeared to depend chiefly on the efficacy of canvas, rags, and soap. Among other objects of interest in the museum was Henry Wilson's original gas fire, of 1883.

After the inspection of the works laboratories and museum, the members of the Association were entertained to light refreshments in the offices in Meadow Lane.

At the subsequent meeting, Mr. C. S. SHAPLEY, Leeds City Gas Engineer and General Manager, and President of the Institution of Gas Engineers, was present. Mr. Firth delivered his Address, a section of which, relating to the recovery of benzole at gas-works, is published in the "JOURNAL" to-day.

Mr. SHAPLEY, who was invited to address the gathering at the conclusion of the President's Address, assured the Yorkshire Junior Association that in Mr. Firth they had as President a very capable and very enthusiastic servant of the gas industry. So far as concerned the Leeds Gas undertaking, Mr. Shapley said they were having a good deal of expense at the present time, but they had a very rosy future, because 93 p.ct. of the undertaking's debt was due to fall out in 1935, and he felt sure that the relief then would be such that the price of gas would be reduced by probably 1s.

Mr. Firth's address, continued Mr. Shapley, was a very fine one, and, in referring to benzole recovery, he was touching on a most important problem. It was a matter which would receive a good deal of attention at the next annual meeting of the Institution of Gas Engineers, to be held next June in Leeds. The points brought out that day by Mr. Firth would no doubt be amplified then, and it would probably be realized that the gas industry was losing a very valuable potential customer in not developing that side more fully.

Mr. HORWILL, from the Chair, moved a hearty vote of thanks to the Leeds Gas Committee, Mr. Shapley, and the staff at Meadow Lane for their hospitality.

Mr. J. W. HOLROYD (Elland) seconded the motion, which was carried unanimously.

Mr. SHAPLEY, in responding, said that after the Institution meeting at Leeds next June, the new meter shops would be open to inspection, and he would be very glad indeed to welcome the Yorkshire Junior Gas Association there at the earliest opportunity. He believed they would find the new shops for the distribution and repair of meters, stoves, fires, &c., unique in many respects.

Mr. C. H. CHESTER (Wakefield) moved a vote of thanks to Mr. Firth for his Presidential Address, and Mr. F. MURPHY (Barnsley) seconded.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The Charter Dinner.

SIR,—Referring to the menu I had the pleasure of designing, I should esteem it a favour if you would allow me to mention the firm, Messrs. Whitehead, Morris, & Co., Ltd., Tower House, Holland Street, E.C., who reproduced the design, as they did, at the time, the design for the Presidential Certificate.

It is one thing to evolve a design, but the reproduction of the same is a work demanding great care and technical skill; and in this particular instance I, for one, tender them my appreciation and thanks.

F. D. MARSHALL.

19, *Queen Anne's Chambers, S.W., Nov. 25, 1929.*

Creosote.

SIR,—In view of the excess stocks of creosote, and of its apparent unsuitability as an enriching material in water gas manufacture, is there any reason why it should not be offered to steamship companies for combustion under oil-burning boilers? This seems to me to be a possible outlet.

Has creosote oil ever been tried in heavy oil engines?

ROY SUMMERSON.

Gas-Works, Luton, Beds., Nov. 25, 1929.

LEGAL INTELLIGENCE.

HOUSING CONTRACTOR AND GAS COMPANY.

Two actions arising out of arrangements made for the supply of gas services to 49 houses on an estate belonging to the Corporation of Harwich came before Mr. Justice MacKinnon in the King's Bench Division on Wednesday and Thursday of last week.

The first was brought by Messrs. Lister Mawby (Builders), Ltd., of Gray's Inn Square, London, against the Corporation, claiming £109 as the balance of the agreed price for the construction of the houses; while in the second action the Harwich Gas & Coke Company, Ltd., sued Lister Mawby (Builders), Ltd., for a similar amount in respect of the cost of putting in the services.

Mr. Earengay, for Messrs. Lister Mawby, explained that all the work had been carried out under the contract entered into by them with the Corporation for building these 49 houses, but the Corporation had retained £109 of the contract price, and they claimed they were entitled to do this because, as they said, the contractors had sub-contracted the work of putting in the gas services to the Harwich Gas Company, and the Corporation were entitled to require that all sub-contractors were paid and to withhold the amount, £109, which had not been paid to the Gas Company. The contractors said that the orders to the Gas Company to do the work were given by the Corporation through their Clerk of Works, and not by the contractors, and that the Corporation had no right to retain the money and presumably to pay the Gas Company. There was a *bona fide* dispute between the contractors and the Gas Company as to the amount for which the former were liable, and the contractors said they were only liable for the benefit they had derived from the work, which was not £109, but at the most £50.

Mr. H. I. P. Hallett, for the Corporation and the Gas Company, submitted that the former were bound to see that the Gas Company were paid before they made a final settlement with the contractors.

His Lordship, giving judgment in both actions, said the arrangement made between the Corporation and the Gas Company with regard to these houses that were about to be constructed was that the Gas Company should lay the mains in the roads at their own cost, and the Corporation should pay for all connections from the main to the houses. He was satisfied that in their contract with the builders, Messrs. Lister Mawby, the Corporation intended that the builders should get the service pipes from the main up to the houses provided, pay the cost of it, and include that as part of the cost of building the houses. At a certain date the Corporation officials desired to have the service pipes from the main to the houses put in, and their representative approached the builders' manager for the purpose, and at the latter's suggestion that it would be more effective if he went to the Gas Company himself. He called and asked them to lay the service pipes. In that way the work was done, and the Gas Company sent in their bill to the builders for £109, the price of the work, but the money was not forthcoming.

His Lordship thought the clear meaning of the contract was that the builders had got to pay the people who were to be called in—obviously the Gas Company—to do the work of putting down the pipes up to the houses. The Gas Company having done this work, as he held, at the request of the builders, under their contract with the Corporation, the next question was whether the charge of £109 was a reasonable one, and he thought it was.

The last matter to be decided was whether the Corporation's architect, the Borough Surveyor, was justified in refusing a certificate for the payment to the builders of the balance of £109. The architect said to the builders in effect: "Here is this bill of the Gas Company's—are you going to pay it?" and they received no reply. Quite apart from the common sense view of the matter, he thought the architect was within the contract in so acting, and he was right in saying that he would not issue his certificate for the balance, because the condition in the contract that the builders should discharge all liabilities under it had not been fulfilled.

There would therefore be judgment for the Corporation in the first action, and judgment for the Gas Company for £109 in the second action, with costs in each case.

A stay of execution was refused.

PARLIAMENTARY INTELLIGENCE.

[From Our Special Correspondents.]

HOUSE OF LORDS.

Special Orders.

The following Special Orders have been approved by the House of Lords, without amendment: Bury St. Edmunds, Bilston, Gravesend and Milton, Horley District, Ipswich, and Sandown. The Horsham and Prescot Orders have been approved with modifications, and the Sutton Order has been approved with an addition.

The Watford and St. Albans Gas Order was laid upon the table of the House, and referred to the Special Orders Committee, which also has before it the East Hull Gas Order and the Halstead Gas Order.

HOUSE OF COMMONS.

Special Orders.

The following Special Orders appeared on the Order Paper for approval by the House of Commons on Nov. 25: Gravesend and Milton Gas Light and Coke Company; Horley District Gas Company; Ipswich Gas Light Company; Sandown Gas and Coke Company, Ltd.; and Prescot Gas Company (with a modification).

Profit-Sharing and Co-Partnership.

Mr. Mander, M.P. for East Wolverhampton, asked the Minister of Labour, in view of the fact that the number of employed persons affected at present by profit-sharing or co-partnership schemes was only in the neighbourhood of 1 p.ct. of the employed population, what steps the Government proposed to take to increase substantially this percentage, and so promote an industrial order based on partnership and co-operation.

Miss Bondfield replied that schemes of this character could only be put into successful operation as the result of voluntary action by the parties directly concerned. She agreed with the views on the matter expressed by the Balfour Committee.

Use of British Tar.—Government Departments and Home Industries.

Following the recent references by Mr. Will Thorne and Sir Frederick Hall in the House of Commons to the use of home-produced tar on our roads, Mr. P. J. Hannon, the member for Moseley, has given notice that to-day (Nov. 27) he will ask the Minister of Transport whether, seeing that increased use of British tar will be helpful to the coke oven and steel industries, and consequently to the coal industry, his Department has adopted or approved any financial scheme relating to road construction which will encourage its fullest use.

Mr. Hannon is Hon. Secretary of the Industrial Group in the House of Commons, and Vice-President of the Birmingham Chamber of Commerce.

MISCELLANEOUS NEWS.

SOUTH SUBURBAN SOCIAL ATHLETIC CLUB.

The Annual Dinner of the Bromley Branch of the South Suburban Gas Company's Social Athletic Club was held on Tuesday, Nov. 19, at the White Hart Hotel, Bromley.

There were 103 guests present, presided over by Mr. W. M. Judd, supported, among others, by Dr. C. Carpenter, Chairman of the Company, Mr. J. Terrace, Chief Engineer, Mr. W. Wastell, Secretary, and Mr. J. King. Through indisposition, Mr. F. G. Gorman, Assistant Engineer, was unable to be present.

Mr. J. King, proposing the toast of the "Athletic Club," said it was alive in all its sections. Perhaps it was not so strong in numbers as it might be, but what it lacked in quantity it amply made up for in quality. The indoor section was making good progress under the management of Mr. Isard.

Football was started ten years ago and the footballers soon went to the top of the tree, where they had been ever since. Their first eleven this year won the Senior Division of the South Suburban League, and their second was among the three top teams.

The tennis section had also gone ahead by leaps and bounds.

The cricket section had lain dormant for several years—at one time they thought it extinct—but through the help of the Town office, who were taking an interest in the club of the Bromley Works, and the Secretaryship of Mr. Manly, the club had made good progress. Mr. Sumner had been of great assistance to the bowls section. Though they had not won as many matches this season as last, they had won good games and lost good games. What was more, the gentlemen against whom they played always said they would only be too pleased for them to come again. He congratulated Mr. Sumner on getting Kent County honours. He hoped that before long he would be able to congratulate other members. In Kent County competitions, members had this year gone further than ever before. Their rink in the "Daily News" competition went within one shot of winning the championship of Kent.

The Amateur Sports Guild, with headquarters at Sydenham, would be started in a few weeks, and if the Directors were backed up it would be a fine thing for the workpeople. Whatever the outcome of the Guild, Mr. King appealed to them not to forget what Mr. Terrace and Mr. Judd had done for the sports section in the past.

Mr. Judd, responding, said that the football team was one of the finest junior teams in the country.

Mr. H. J. Bray proposed "The Presidents and Vice-Presidents"—Dr. C. Carpenter and Messrs. J. Terrace, W. Wastell, F. G. Gorman, H. Baldry, and W. A. Tweed. The President and Vice-Presidents, he said, had been very keen on the new Sports Guild and very active in its formation, and nothing gave them more pleasure than to know that what they had done was appreciated by those who had benefited by their efforts.

Mr. Terrace wished to tell them how much the President and Vice-Presidents wanted to see their sports successful. The Directors found the sports activities of the Company were developing so rapidly that it was difficult to find out what each club (in the various districts) really required, and to grant requests without risk of unfairness to others. So they proposed that the activities should continue in each district as before, but that a body be formed which would link the various clubs together and also represent them on the Board. Dr. C. Carpenter was prime mover in the scheme, and when the Sports Guild really got to work, they would have a sports organization second to none in the country.

Mr. W. A. Tweed responded

The trophies and medals were presented by Mr. Terrace.

BRITISH SULPHATE OF AMMONIA FEDERATION, LTD.

Ninth Annual Report.

The following extracts are from the Ninth Annual Report of the Council and Executive Committee of the Federation for the year ended June 30, 1929.

The past year was the thirty-second year of propaganda work undertaken successively by the Sulphate of Ammonia Committee, the Association, and the Federation. On Dec. 1, 1926, Nitram, Ltd., became responsible for propaganda.

The World's Production and Consumption of Fixed Nitrogen.

During the year under review, there was an increase of 389,000 tons, or about 22½ p.ct., in the production of the forms of nitrogen enumerated below, Chile nitrate contributing 100,000 tons and the other forms 287,000 tons to this total. The total consumption increased by 230,000 tons, or 14 p.ct., following on an increase of 330,000 tons, or 25 p.ct., in the previous season. The tabulated figures are offered as fair estimates of the output of the various forms, but strict accuracy is not claimed for them; in the light of more recent information the figures for previous years have been slightly increased.

In view of the unsatisfactory economic position of farmers in many lands, the increase of 230,000 tons of nitrogen in the world's consumption during the year under review must be regarded as satisfactory. Chilean nitrate secured about 12 p.ct. of this increase, and the remaining 88 p.ct. fell to sulphate of ammonia and other forms of nitrogen. The most notable increases in consumption took place in the U.S.A., Northern Europe, and the Japanese Empire. Selling prices during the year for synthetic forms of nitrogen were only slightly below the level for 1927-28, but there was a reduction of about 10 p.ct. for Chilean nitrate. For 1929-30 prices for all forms of nitrogen have been reduced by about 10 p.ct. The significant feature observable in the nitrogen statistics for the year 1928-29 is the tendency for production to outrun consumption. For 1929-30 a further considerable increase in production is expected; the estimates vary from 250,000 to 400,000 tons of nitrogen. An increase of about 22 p.ct. in consumption is required to absorb the lower of these last two figures together with the stock carried forward from 1928-29. Concerted efforts will be required on the part of the many groups producing nitrogen if consumption is to be maintained at this high level.

Geographical Distribution of Nitrogen Consumed.

British and American exports of sulphate of ammonia for the last nine calendar years were:

—	Exported from		Total.
	United Kingdom.	United States.	
	Tons.	Tons.	Tons.
1920	110,016	89,566	199,582
1921	128,433	102,614	231,047
1922	145,255	147,331	292,586
1923	247,536	150,595	398,131
1924	263,012	115,047	378,059
1925	248,752	122,498	371,250
1926	150,167	174,159	324,326
1927	251,640	140,679	392,319
1928	377,635	93,016	470,651

Ton = 2240 lbs.

The figures in the following table are to be taken as estimates only:

Consumption in Metric Tons of Pure Nitrogen.

Countries.	Fertilizer Year 1928-29.				
	Ammonium Sulphate Equivalent.	Chilean Sodium Nitrate.	Calcium Cyanamide.	Other Forms of Synthetic Nitrogen.	Total.
Group 1.— Scandinavia, Russia, Baltic States, Germany, United Kingdom, Holland, Belgium, France, Switzerland, Austria, Czechoslovakia, Hungary, Roumania, Jugoslavia, and Bulgaria	403,330	167,780	160,240	288,890	1,020,240
Group 2.— Spain, Portugal, Azores, Madeira, Italy, and Sicily, Egypt, and other Mediterranean countries	77,770	61,430	13,460	22,520	175,180
Group 3.— Indian Empire, Ceylon, Philippines, Straits, Dutch East Indies, Siam, Borneo, Japan, Korea, and China	195,980	16,860	19,380	12,680	244,900
Group 4.— Africa (excluding Egypt) and neighbouring islands	3,000	3,830	..	710	7,540
Group 5.— United States, Canada, Central and South America, West Indian Islands, Cuba, Puerto Rico, and Hawaii	132,000	167,920	24,400	92,870	417,190
Group 6.— Australasia	4,730	1,630	..	670	7,030
Total	816,810	419,450	217,480	418,340	1,872,080

Comparative Figures for Fertilizer Year 1927-28.

Group 1	386,198	145,300	149,614	228,870	909,982
,, 2	72,577	58,645	14,366	15,320	160,908
,, 3	166,234	13,035	19,708	2,070	201,047
,, 4	2,547	5,590	..	128	8,265
,, 5	113,953	168,347	18,680	55,450	356,430
,, 6	3,790	1,805	..	100	5,695
Total	745,299	392,722	202,368	301,938	1,642,327

The consumption of "ammophos" is included under calcium cyanamide.

The bulk of calcium cyanamide made in Japan is converted into ammonium sulphate and is included under the latter.

Home Production and Distribution.

The figures for total production are taken from the Alkali Inspector's report, and relate to the calendar year, while the remaining figures relate to the "fertilizer" year commencing July 1 in each year. Hence the quantity stated below as exported for "1928" was

World Production and Consumption of Nitrogen in Metric Tons of Pure Nitrogen for the Fertilizer Years.

—	1923-24.	1924-25.	1925-26.	1926-27.	1927-28.	1928-29.
Production—						
Bye-product sulphate of ammonia	264,600	278,300	296,700	328,200	368,000	376,000
Synthetic sulphate of ammonia	231,100	255,000	289,200	300,000	367,000	485,000
	495,700	533,300	585,900	628,200	735,000	861,000
Cyanamide*	104,000	115,000	150,000	180,000	204,000	210,000
Nitrate of lime	18,000	25,000	30,000	81,000	105,000	136,000
Other forms of synthetic nitrogen †	51,100	66,100	120,700	133,400	236,000	365,000
Other forms of bye-product nitrogen †	50,200	47,400	47,700	42,300	54,000	51,000
Chilean nitrate of soda	338,500	367,500	399,400	199,600	390,000	490,000
Total production	1,057,500	1,154,300	1,333,700	1,264,500	1,724,000	2,113,000
Consumption—						
Consumption of manufactured nitrogen	719,000	786,800	934,300	1,037,500	1,250,700	1,453,000
Consumption of Chilean nitrate of soda	340,000	363,000	324,200	275,200	391,300	419,000
Total consumption	1,059,000	1,149,800	1,258,500	1,312,700	1,642,000	1,872,000
Agricultural consumption about	934,000	1,020,000	1,117,000	1,200,000	1,490,000	1,684,000

*Excluding the bulk of the cyanamide made in Japan, which is included under synthetic sulphate of ammonia. † Including ammonia liquor used for industrial purposes.

exported during the year July, 1928, to June, 1929. The figures represent English tons of sulphate of ammonia.

—	Total Production of Ammonia as Sulphate of Ammonia. (Based on Alkali Report.)	Production of Sulphate/ Ammonia as such.	Exported. (Customs Returns, excluding Channel Islands and I.F.S.)	Used for Home Agricultural Consumption.	Nitrate of Soda Used for Home Agricultural Use.
1925 . .	442,402*	394,850	223,210	168,650	35,000†
1926 . .	331,348*	322,270	137,320	169,340	33,000†
1927 . .	487,648*	471,230	302,604	167,720	37,000†
1928 . .	630,577*	627,000	428,437	186,710	49,500†

* Basis 25 p.ct. ammonia. † Estimated.

N.B.—The total consumption of Chilean nitrate is estimated at 73,000 tons, as against 70,500 tons for last season. During the year there was a decline in consumption for industrial purposes, but an increase for agricultural use.

HOME AGRICULTURAL CONSUMPTION.

Home sales of sulphate of ammonia showed a very satisfactory increase of nearly 19,000 tons. This is undoubtedly due to the cumulative effect of the advisory work of recent years. The total annual consumption of pure nitrogen in the United Kingdom for all purposes is now about 72,500 tons, of which about 23,000 tons is used in industry.

The detailed figures for sulphate of ammonia are as follows:

Home Consumption in	Scotland.	Ireland.	England, Wales, and Channel Islands.	Total.
1925–26	44,930	26,140	97,580	168,650
1926–27	43,670	28,280	97,390	169,340
1927–28	41,880	26,700	99,140	167,720
1928–29	47,072	30,902	108,736	186,710

(Tons of 2240 lbs.)

EXPORTS.

Exports show an increase of 125,800 tons, or about 41 p.ct. on last year's figures.

The following figures show the shipments to the principal markets:

—	1927-28.	1928-29.
Spain, Portugal, Canaries . . .	85,050	104,396
Japan	100,915	146,087
China	49,800	93,332
West Indies and Mauritius . . .	14,958	17,919
India and Ceylon	11,291	30,808
Australia and New Zealand . . .	90	5,220

GENERAL AVERAGE PRICES.

The following are the average prices per ton for all deliveries, home and export, free on rails at makers' works in single bags free:

—	For 20·4 P.Ct. Nitrogen.	For 21·1 P.Ct. Nitrogen.
	£ s. d.	£ s. d.
1925–26	9 11 3	10 18 9
1926–27	8 8 7	9 16 1
1927–28	7 14 2	9 1 8
1928–29	7 1 9	8 9 3

MEMBERSHIP.

The Federation numbered on July 1, 1929, 400 members (a decrease of 3 on 1927-28), whose annual production represents about 92 p.ct. of the total annual output in Great Britain and Ireland on the basis of the production for the calendar year 1928. The decrease is due to alterations in constitution and amalgamations, not to withdrawals. The Federation continues to represent a very large proportion of the output in India and South Africa.

HOME PRICES.

The following are the prices charged to British farmers per ton delivered to buyer's nearest station, in recent years:

Sulphate of Ammonia.

—	1922-23. Neutral Basis, 25¾ P.Ct. Ammonia.	1923-24. Neutral Basis, 25¾ P.Ct. Ammonia.	1924-25. Neutral Basis, 21·1 P.Ct. Nitrogen.	1925-26. Neutral Basis, 21·1 P.Ct. Nitrogen.	1926-27. Neutral 20·6 P.Ct. N. Minimum.	1927-28. Neutral 20·6 P.Ct. N. Minimum.	1928-29. Neutral 20·6 P.Ct. N. Minimum.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
July	16 3 0	14 5 0	14 0 0	12 5 0	13 1 0	12 6 0	10 13 0
August	16 3 0	14 5 0	14 0 0	12 5 0	13 1 0	9 18 0	10 0 0
September	16 8 0	14 10 0	14 2 0	12 7 0	11 7 0	10 0 0	10 0 0
October	16 8 0	14 12 6	14 4 0	12 9 0	11 9 0	10 2 0	10 2 0
November	16 13 0	14 15 0	14 6 0	12 11 0	11 16 0	10 5 0	10 5 0
December	16 13 0	14 16 0	14 8 0	12 13 0	11 18 0	10 8 0	10 8 0
January	16 18 0	15 2 0	14 10 0	12 15 0	12 0 0	10 11 0	10 11 0
February	16 18 0	15 3 0	14 12 0	12 18 0	12 3 0	10 13 0	10 13 0
March/May	17 3 0	15 5 0	14 14 0	13 1 0	12 6 0	10 13 0	10 13 0
June	17 3 0	15 5 0	12 5 0	13 1 0	12 6 0	10 13 0	10 13 0

Nitrate of Soda.

15½ P.Ct. Nitrogen.

Spring price about	£ s. d. 14 5 0	£ s. d. 14 5 0	£ s. d. 14 0 0	£ s. d. 14 0 0	£ s. d. 13 10 0	£ s. d. 11 10 0	£ s. d. 10 12 0

N.B.—The above prices for nitrate are calculated on the same delivered basis as the sulphate prices; the net price at U.K. ports was about £1 per ton less.

EXPORTS OF SULPHATE OF AMMONIA

From the United Kingdom for the Fertilizer Years ended May 31, 1908-1928, and June 30 thereafter.

Taken from Customs returns. Ton = 2240 lbs.

—	1908-12. Average.	1913-14.	1918-19.	1919-20.	1920-21.	1921-22.	1922-23.	1923-24.	1924-25.	1925-26.	1926-27.	1927-28.	1928-29.
France	11,801	3,977	11,245	19,901	24,518	41,272	25,602	18,917	26,943	3,610	..	..	302
Channel Islands	651	656	824	433	748	1,314	1,532	1,330	964	1,553	1,082	1,106	1,128
Spain	53,298	52,709	1,997	5,936	42,047	3,288	53,859	50,449	99,558	68,304	36,426	66,289	83,564
Portugal	1,903	3,709	521	687	716	1,481	2,145	1,771	1,233	2,922	2,244	3,100	4,954
Canary Islands	6,919	8,709	1,197	2,318	3,351	7,752	9,479	9,722	12,802	14,756	12,324	15,661	15,878
Italy and Sicily	10,360	4,527	3,782	1,335	2,486	691	3,404	5,675	9,018	4,898	2,851	3,982	5,625
Egypt	668	279	135	649	3,598	1,669	2,969	2,460	4,431	3,098	1,455	577	2,125
Sudan	..	..	..	..	..	..	..	..	50	45	70	1,550	1,184
Java	26,097	38,319	..	20,243	25,506	29,115	35,819	35,327	35,660	28,534	4,293	29,610	11,699
Japan	61,627	115,012	6,325	53,403	2,025	7,353	16,802	84,936	36,141	48,397	37,667	100,915	146,087
China	481	2,089	..	505	1,305	1,354	7,931	10,827	1,245	8,034	2,738	16,312	10,028
Hong Kong	544	2,119	..	1,090	50	975			6,530	10,420	21,468	33,499	83,304
West Indies, British . . .	3,546	2,602	3,435	1,384	5,584	1,043	3,393	3,545	3,955	2,682	2,740	4,445	3,504
Ceylon	1,383	2,109	..	350	..	550	615	1,650	2,754	6,384	3,492	8,833	12,676
India and Burma	113	166	4	10	60	1	167	638	544	5,712	1,006	2,458	18,132
Mauritius	5,680	5,764	957	4,819	8,888	5,405	4,450	6,043	5,206	7,358	3,994	4,242	7,835
Total, with other countries	272,296	324,100	38,450	116,567	135,126	117,691	187,577	259,604	262,095	224,763	138,401	303,702	429,565
Calendar Years (1st year) .	..	324,704	25,495	92,912	110,016	128,433	145,255	247,536	263,012	248,752	150,167	251,640	377,635

ORIENTAL GAS COMPANY, LTD.

Annual General Meeting.

The Annual General Meeting of the Company was held at the London Offices, Finsbury House, Blomfield Street, E.C., on Wednesday, Nov. 20—Mr. STANLEY H. JONES, M.Inst.C.E. (the Chairman), presiding.

The SECRETARY (Mr. S. Rainer) read the notice convening the meeting and the report of the Auditors; and the report of the Directors and the statement of accounts for the financial year ended June 30 last were taken as read.

The CHAIRMAN: The year under review has been an interesting and important one; for, having regard to the future development of our business, your Directors have, under their Manager's advice, supported by that of a well-known Consulting Engineer, Mr. George Evetts, M.Inst.C.E., of Westminster, who has paid a visit to our works in conjunction with a visit he also paid to the works of the Bombay Gas Company, carried out certain alterations and improvements to the Sealdah Works in connection with the condensing, exhausting, and purifying plant, designed to facilitate the supply of gas from the works, and have installed in the South-Western area of Calcutta a district gasholder for improving the pressure of gas in the distant parts of the Company's district of supply. These alterations have resulted in a greatly improved service to our customers; and this has been further enhanced by erecting also on the ground secured for the district holder a district office, for dealing with the requirements of customers in the Southern area, who otherwise would have to travel a considerable distance to the Company's office and showroom in the Northern part of Calcutta. I may say that, as a consequence of acting in conjunction with the Bombay Gas Company, there was a saving effected in regard to the expense incurred in connection with Mr. Evetts's visit; and the Directors feel highly gratified at the very satisfactory report presented to them by Mr. Evetts on the Company's undertaking and future prospects. I am happy to tell you that the whole cost of the alterations up to June 30 last at our works, and the cost of the district holder and office, have been borne on the revenue of the Company.

AN OBSOLETE TEST.

Last year I reported to you that negotiations had been in progress with the Corporation of Calcutta respecting the substitution for the now obsolete test for illuminating power of the present-day test for ascertaining the heating value of the gas, which would enable the Company to afford an equally satisfactory gas for the public lamps at a lower price, and result in an equally useful and cheaper supply to the Company's consumers generally. Up to the present, however, no agreement as to the proposed change has been reached; but negotiations are still continuing. In my speech last November, I endeavoured to explain how advantageous it would be for Calcutta if the change proposed were adopted; and I would ask our Indian friends to believe that the Company, in making its proposals, is sincerely anxious to make its contribution towards the much-needed improvement in the atmospheric conditions thereby affording smokeless commodities in the form of gas and coke to the public on a much wider scale. It does seem a pity that raw coal should be burnt to the extent I understand it is burnt in Calcutta, and the products of combustion allowed to escape into the atmosphere and contaminate it so seriously that the health of the inhabitants is, according to Press statements, most injuriously affected. Apart from this, it is most unscientific and economically wasteful and unsound to burn raw bituminous coal in a boiler furnace. I am sure our friends overseas wish to keep up to date, and fully realize that health and cleanliness of atmosphere and the installation of labour-saving appliances in the house and in the factory are ever in the forefront nowadays. Gas undertakings play their part in these ever-progressive times, and the Oriental Gas Company in its service to Calcutta would, in my view, be failing in its duty, were it not to point out whenever it can where improvements can be made in the lighting and heating conditions of the great city of the East where we carry on our operations.

THE ACCOUNTS.

I will now briefly review the accounts. The capital account remains as before. With regard to the revenue account, on the expenditure side coals cost £40,378, as compared with £41,854 in the previous year, a reduction of £1476. Salaries, wages, and purification are a little more than before. Repairs and maintenance of works were £27,941, as compared with £21,433, an increase of £6508. This increase is due to the expenpenditure incurred on the installation of the district holder and works alterations. Distribution charges are lower; being £19,343, as compared with £21,146, a decrease of £1803. This is due to there having been less mainlaying work carried out. Public lamps costs were rather higher at £4048, as compared with £3528. Rents, rates, and taxes were lower by £784; being £7085, as against £7869. Management charges were more, being £11,063, as compared with £10,131. This is partly due to income-tax paid on Directors' fees being charged, in accordance with the New Act, under this head, instead of under rents, rates, and taxes as hitherto. Bad debts were £63 more. Law charges were much the same at £155. Other charges do not call for much comment, I think. Passages are £294 higher, owing to a larger number of the English staff being home on leave than in the previous year. On the receipts side of the account, gas rental was £124,229, as compared with £123,385, an increase of £844. Meters and stove rentals were £5600, as against £5109, an increase of £491. Residual receipts were £20,495, as compared with £20,651. Total expenditure was £122,989, and total receipts were £150,441, resulting in a balance of profit of £27,452. In the net revenue account, bank interest was £1378, as compared with £1860, a reduction of £482. Interest on the Company's investments was £574 as before, and profit on exchange was £6695, as compared with £6439, an increase of £256. We have already paid an interim dividend of 3½ p.ct., *less* tax, in May last; and from the balance now available we recommend a final dividend of 4½ p.ct., *less* tax.

FURTHER FIGURES.

Now, gentlemen, you may ask why not distribute a higher dividend; and I think it well to point out that the reason your Directors do not recommend this is that the Company has a bank overdraft of £21,520, and to pay a higher dividend would mean increasing our indebtedness to the bank. We on this side of the table are most anxious to work off the bank loan and to establish our depreciation and renewals suspense accounts in funds. This we wish to achieve without raising further capital, which only results in loading the Company with a permanently increased dividend liability, and makes its position less stable. Pursuing my review, the reserve fund, depreciation account, renewals suspense account, and exchange equalisation account remain as last year. We carbonized 49,297 tons of coal, as compared with 45,476 tons in the previous year. We sold 22,359 tons of coke, as compared with 20,651 tons; 1906 tons of breeze, as compared with 1336 tons; 467,772 gallons of tar, as against 586,839 gallons, the amount in stock at the end of the year being largely owing to a slack demand. There were 249 tons of sulphate sold, as compared with 222 tons before. Turning to the balance-sheet, amounts due by the Company were £12,995, as contrasted with £14,328. The loan from the bank was £21,520, as compared with £31,035, a reduction of £9515. On the credit side, cash at the bank and in hand was £3149, as against £3451. Investments remain as before (£19,657); but the market value (£14,387) is rather more than £400 down as compared with last year. Amounts due to the Company were £6983, as against £7622 previously. The capital expended per million c.ft. of gas sold is £745, as compared with £763 last year, a reduction of £18.

MORE GAS SOLD.

Our Manager reports that the whole of the Company's buildings and plant are in good and serviceable condition. As stated on the face of the accounts, the increase in the sale of gas is nearly 2½ p.ct.; some 1144 additional gas-consuming appliances having been installed. Mr. Snelgrove states that relations with our employees have been satisfactory, as also with the public authorities; and the staff have rendered good service. I would like, before sitting down, to bear testimony to the excellent work performed by our staff abroad and at home, which will, as usual, be the subject of a special motion. I have known Mr. Snelgrove and Mr. Rainer, our principal officers, many years now; and I will just say this—that both have given of their best to the Company, and it has been a very great pleasure to be associated with two such able and devoted men. I will now move the adoption of the report and accounts.

Mr. BERTRAM W. ELLIS, Assoc.M.Inst.C.E., seconded the motion.

Mr. R. M. LONG, referring to the heavy sums allocated to repairs and renewals, asked whether some proportion of these could not have been charged to capital account.

The CHAIRMAN replied that this could have been done, had the Board thought it wise.

Mr. LONG then raised the question of the capital account, in which, he pointed out, the expenditure on land, buildings, plant, machinery, and mains stood at £430,000, while the total capital issued was £300,000. He asked whether shareholders were not entitled to have stock given them to represent this extra £130,000 of capital outlay.

The CHAIRMAN remarked that this point had been raised before, and had been fully discussed. The Directors, having regard to all the circumstances of the case, felt that it was most desirable to keep down the capital; and in this policy he was confident that they had the support of the great majority of shareholders.

The report and accounts were then unanimously adopted.

DIVIDEND AND RE-ELECTIONS.

On the proposition of the CHAIRMAN, seconded by Mr. W. G. BRADSHAW, C.B.E., it was resolved to pay a dividend at the rate of 8 p.ct., *less* income-tax, for the year, *less* 3½ p.ct. paid on account.

Mr. H. H. MACLEOD said that no one had the interests of the Company more at heart than the Chairman, who presided most ably over the Board and was an expert gas administrator. He had therefore great pleasure in proposing his re-election as a Director.

This was seconded by Mr. B. M. GILL, and agreed to.

The Auditors (Messrs. S. W. Savage and F. J. Bradfield) were thereafter re-appointed on the motion of Mr. D. H. MCLAUCHLAN, seconded by Mr. R. H. GLEN.

VOTES OF THANKS.

Mr. ELLIS, proposing a hearty vote of thanks to the staff of the Company in Calcutta and London, said the Chairman had already expressed their appreciation of the services of Mr. Snelgrove, the General Manager and Engineer, over a long period of years. According to recent advices, Mr. Snelgrove had had to go away for a short while, but they hoped he would return in perfect health. His Chief Assistant, Mr. Garsed, had had a very busy year. During the absence on leave of Mr. Smith, the Works Manager, Mr. Garsed had had to look after the completion of the re-arrangement of plant, which work he had performed in the most efficient manner. Mr. Bacon, the Mains Superintendent, had been busily engaged extending the mains to the south of the town. Mr. Morrison, Mr. Bath-

gate, and other members of the staff had also done excellent work. Then, of course, there were those in the London Office. He had spoken on previous occasions about Mr. Rainer, who had spent over forty years in the Company's service. He and his Assistant, Mr. Hentsch, were most loyally devoted to the Company. They were indeed grateful to the whole of their staff, both European and native.

Mr. Gill seconded the vote, which was heartily accorded.

Mr. Rainer acknowledged the vote on behalf of Mr. Snelgrove and himself and the staffs in Calcutta and London.

Mr. F. J. Bradfield proposed a vote of thanks to the Chairman and Directors. He remarked that, in his position as Auditor, he had an opportunity of studying the accounts closely; and he would like to associate himself with the policy pursued by the Board. The capital at the present time was in a very satisfactory position. For the past half-dozen years, nothing had been charged to capital; and there had been a reduction from £924 to £743 per million c.ft. of gas. This was a very big reduction; and the position was such as to afford them great security.

Mr. Long seconded the vote, which was passed unanimously.

The Chairman, in acknowledgment, said the Board very much appreciated this demonstration of confidence in them.

GAS PUBLICITY IN EDINBURGH.

Department's Prominence in the Local Press.

It would appear that the gas industry as a whole, and the Edinburgh Corporation Department in particular, are well served by the Local Press of that City. Judging by the amount of informative matter which has appeared recently in the Edinburgh papers, gas would seem to be arousing general interest.

A long account of the Scottish Junior Gas Associations' visit to the Granton Works was published in the "Edinburgh Dispatch" of Nov. 18, and also in the "Edinburgh Evening News" of the same date, in connection with which a photograph of the new holder now in course of construction was reproduced in the former paper two days later, giving a good idea of the size of the holder and method of erection.

In the "Edinburgh Evening News" for Nov. 19 was an article by Councillor Andrew Gilzean, Vice-Convener of the Gas Committee, under the title "Is the Gas Undertaking a Back Number?" The question was most convincingly answered in the negative by the writer, who showed how the presence of a lively competitor, such as electricity, stimulated our industry into greater activity and progress.

Whatever the future held, said Councillor Gilzean in his article, there was no doubt that now, from an economic viewpoint, gas left its rival far behind. As a heating agent it was difficult to see how, even with "super" stations, it could hope to compete with gas.

He went on to point out how practically nothing was lost in the process of coal carbonization, and some impressive figures were put forward to indicate the magnitude of the gas industry.

Turning to their own works at Granton, it was stated that during the past five years the increased make had totalled 530 million c.ft. per annum, equal to the entire needs of a town the size of Greenock. Since 1921, the price of gas had gone down in Edinburgh from 5s. 8d. per 1000 c.ft. to 3s. The wages bill amounted to £140,000 a year, and employment was found for 1000 persons.

Coal, concluded Councillor Gilzean's article, is the nation's stored-up energy, and any process which so completely secures that energy as does gas, must, in the light of our present-day knowledge, be very far from the dying state in which some folk imagine it to be.

Publicity such as this does much to keep before the public's notice the ever-increasing efficiency of the gas industry, and the real help it can be to all who avail themselves of its services. Advertisements in the Press are essential, but interesting items in the news columns, such as those exemplified in this note, have a value which it is difficult to estimate.

TRADE NOTES.

"Simplex" Water-Gas Plant for Narborough.

The Narborough, Blaby, Enderby, and Whetstone Gas Light and Coke Company, Ltd., have placed an order with the Vertical Gas Retort Syndicate, Ltd., for an improved twin "Simplex" water gas plant of 150,000 c.ft. capacity.

Cannon New Inclined Gas Fires.

Cannon Iron Foundries, Ltd., of Deepfields, near Bilston, Staffordshire, have produced some very attractive show cards in connection with the new inclined gas fire as manufactured by the firm. The cards, which measure 20 in. by 14 in., are executed in eight colours, and are eminently suitable for showroom display purposes.

Spiral-Guided Holder for Bingley.

Bingley Urban District Council have approved a recommendation by the Lighting Committee accepting the tender of the Broadhead Construction Company, Ltd., for the provision of a spiral-guided gasholder and foundation work, at a cost of £9329 for the holder and £1810 for the foundation work. The acceptance of the foundation tender is conditional on the unskilled work being done by local labour.

Bamag-Meguin (Great Britain), Ltd.

The British Patent Numbers of the Bamag-Meguin self-balanced shaking and screening plant, advertised in our Supplement of Nov. 20, are 304,549 and 311,219. Several of these units have been recently installed, and descriptive literature, together with particulars of their performance, can be obtained from Bamag-Meguin (Great Britain), Ltd., Broadway Buildings, Westminster, London, S.W. 1.

COAL TRADE REPORTS.

From Our Own Correspondents.

NORTH-EAST COAST.

While there are still some irregular spots, the general trend of the market has continued for the better. Tonnage for certain destinations has been difficult to obtain, so that in some instances prompt cargoes have been thrown on the market at the last moment. But steam coals have been remarkably firm throughout, and the ordinary run of Durham unscreened coals have been steadier than for some time. The nature of the inquiry and demand from abroad rather indicates that consumers are inclined to lay in stocks in view of the uncertain outlook.

Wear Special gas coals are quoted steadily at 17s. 3d. to 17s. 6d. f.o.b., and best qualities at 16s. 6d. to 16s. 9d. Second-class gas qualities are 15s. 3d. to 15s. 6d. Unscreened coking is rather better at 15s. 6d. to 16s. Best Durham bunkers are in good demand at 15s. 6d. to 16s., seconds being obtainable round 14s. 6d. Best Northumberland screened steams are strong at 17s.

Inquiries for gas coke are numerous, but supplies are said to be practically exhausted to the end of the year, and 26s. f.o.b. is indicated as nominal value for shipment.

YORKSHIRE AND LANCASHIRE.

The demand for best hards on export account remains strong, and the output is practically fully taken; quotations of 18s. to 18s. 6d. being maintained. There is no improvement in trade for secondary qualities, and stocks are increasing. The improved demand for furnace coke continues, and quotations of 23s. to 24s. are maintained. The forward inquiry for industrial fuel is steady. There is a large quantity of washed nuts and slacks on offer. The inquiry for bunker fuel continues quiet, and quotations are weaker. There is a better request for screened gas coal, but the position is unchanged. There is little alteration in the house coal trade.

The following are the Humber bunker and export prices (f.o.b. usual shipping ports):

South Yorkshire—Hards, Association, bunkers 19s., export 18s. to 18s. 6d.; screened gas coal, export 18s. to 18s. 6d.; washed trebles, export 17s. 9d. to 18s. 3d.; washed doubles, bunkers 18s. 6d., export 17s. to 18s.; washed singles, export 15s. 6d. to 16s.; washed smalls (steam), bunkers 15s. 3d. to 15s. 9d., export 14s. to 14s. 6d.; washed smalls (coking), export 14s. 6d. to 15s.; rough slack, bunkers 13s. 6d. to 13s. 9d., export 12s. 6d. to 13s.; smithy peas, export 18s. 6d. to 19s. 6d.

West Yorkshire—Hartley's (f.o.b Goole), bunkers 17s. 9d., export 17s. to 18s.; screened gas coal, export 18s. to 18s. 6d.; washed trebles, export 17s. 6d. to 18s.; washed doubles, export 16s. 3d. to 16s. 9d.; washed singles, export 15s. 3d. to 15s. 6d.; washed smalls, bunkers 14s. 3d. to 14s. 9d., export 13s. 6d.; unwashed trebles, export 17s. to 17s. 9d.; unwashed doubles, export 15s. to 16s.; rough slack, bunkers 13s. 3d., export 11s. 3d. to 11s. 9d.; fine slack, export 9s. 6d. to 10s.; coking smalls, export 11s. 6d. to 12s.

Derbyshire and Nottinghamshire.—Top hards, bunkers 19s., export 18s. to 18s. 6d.; cobbles, export 17s. 6d. to 18s.; washed trebles, export 17s. 9d. to 18s.; washed doubles, bunkers 18s. 3d., export 17s. to 17s. 3d.; washed singles, export 16s. to 16s. 6d.; washed smalls, bunkers, 15s. 3d. to 15s. 6d., export 14s. to 14s. 6d.; unwashed doubles, export 16s.; rough slack, bunkers 13s. to 14s.; export 11s. 6d. to 12s. 6d.; fine slack, export 9s. 6d. to 10s.

Yorkshire, Derbyshire, and Nottinghamshire.—Screened steam coal, bunkers 17s. to 18s., export 16s. 6d. to 17s.; gas coke, export 25s. to 26s.; furnace coke, export 24s. to 24s. 6d.; washed steam, Goole (West Yorkshire), bunkers 17s. 3d.; Hull (West Yorkshire), bunkers 17s. 6d.; Hull (South Yorkshire), bunkers 17s. 9d., export 17s. per ton.

MIDLANDS.

Brisker conditions prevail in the house coal trade. The advance of the season is responsible in some measure. Another reason is that the reduction of output under the Five Counties Scheme has prevented demoralization of prices if it has not made good the advances already announced. Expectations of higher prices with the incoming of December has also stimulated buying. Secondary qualities particularly have been in more active demand. "D.S." nuts have firmed up, prices ranging from 12s. 6d. to 15s. 6d. Warwickshire pits especially have been called upon for good supplies of bakers' nuts at from 18s. to 23s.

Slacks have had an improving market, apart from the industrial demand. So many collieries have installed washing and other cleaning plants that selling values have been enhanced. There is no superabundance of slacks notwithstanding the increased output of domestic fuel at many of the pits. Good medium grades have been selling at 6s. 6d. to 7s. 6d.

In no department save coke is the industrial demand showing any tension. With gas coke tight furnace cokes have been diverted to institutional and domestic heating purposes; but easier conditions have supervened in that direction. Industrialists are apprehensive, however, as to the effect which readjustment in the coal trade may have on costs. Iron smelting cokes fetch about 18s. at ovens.

CONTRACTS OPEN.

Gasholder.

The City of Bradford Gas Department invite tenders for the supply and erection of a gasholder. [See advert. on p. 606.]

STOCK AND SHARE LIST.

[For Stock Market Report, see earlier pages.]

Issue.	Shares.	When ex-Dividend.	Dividends. Prev. Hf. Yr.	Dividends. Last Hf. Yr.	NAME.	Quotations. Nov. 22.	Rise or Fall on Week.	Transactions Lowest and Highest Prices.
£			%p.a	% p.a.				
171,878	Stk.	Aug 15	5	5	Aldershot 5 p.c. max. C.	70—75	..	..
412,992	,,	..	4	4	Do. 4 p.c. Pref.	71—74	..	..
1,551,868	,,	Sept. 26	7⅞	7⅞	Alliance & Dublin Ord.	96—99	..	..
374,000	,,	July 11	4	4	Do. 4 p.c. Deb.	62—65	..	..
522,655	,,	Aug. 29	7	7	Barnet Ord. 7 p.c.	112—115	..	..
900,000	£1	Oct 24	1/4⅓	1/4⅓	Bombay, Ltd.	16/—18/-	..	16/3—17/1½
172,500	10	Aug. 29	8½	9	Bournemouth 5 p.c.	12⅝—13½	..	..
600,050	10	,,	7	7	Do. B 7 p.c.	12⅝—12¾	..	..
439,160	10	,,	6	6	Do. Pref. 6 p.c.	10½—11	..	..
50,000	Stk.	July 11	3	3	Do. 3 p.c. Deb.	54—57	..	..
162,025	,,	,,	4	4	Do. 4 p.c. Deb.	72—75	..	..
957,900	,,	Aug. 29	7½	7½	Brighton & Hove 6 p.c. Con.	113—116	..	..
271,880	,,	,,	6⅔	6⅔	Do. 5 p.c. Con.	100—103	..	..
1,287,500	,,	July 26	5	5	Bristol 5 p.c. max.	87—89a	..	..
855,000	,,	Sept. 12	7½	7	British Ord.	115—118	..	..
100,000	,,	June 27	7	7	Do. 7 p.c. Pref.	112—117	..	..
190,000	,,	,,	4	4	Do. 4 p.c. Red. Deb.	71—74	..	..
450,000	,,	,,	5	5	Do. 5 p.c. Red. Deb.	94—97	..	96½
100,000	10	May 30	6	8	Cape Town, Ltd.	9—10	..	..
100,000	10	Nov. 7	4½	4½	Do. 4½ p.c. Pref.	6¾—7½*	..	..
150,000	Stk.	June 27	4½	4½	Do. 4½ p.c. Deb.	71—76	..	..
696,860	,,	July 25	6	6	Cardiff Con. Ord.	98—101	..	..
887,840	,,	June 27	7½	7½	Do. 7½ p.c. Red. Deb.	99—102	..	..
157,150	,,	Aug. 15	6½	5	Chester 5 p.c. Ord.	87—92b	..	..
98,936	1	Oct 10	1⅔/-	1⅔/-	Colombo Ltd. Ord.	34/—36/-	..	..
94,495	1	,,	1/4⅓	1/4⅓	Do. 7 p.c. Pref.	19/—21/-	..	..
375,402	1	Oct. 10	1/9⅓	1/9⅓	Colonial Gas Assn. Ld. Ord.	23/6—25/6	..	..
187,848	1	,,	1/7½	1/7½	Do. 8 p.c. Pref.	20/—22/-	..	21/6
1,075,280	Stk	July 25	7	5	Commercial Ord.	90—95	..	92—92½
475,000	,,	June 13	8	8	Do. 8 p.c. Deb.	55—58	..	..
787,560	,,	Aug. 15	7	7	Croydon sliding scale	105—108	..	105—105½
493,100	,,	,,	5	5	Do. max. div.	77—82	..	78—79
642,270	,,	Aug. 29	10	7	Derby Con.	118—121e	..	..
55,000	,,	June 27	4	4	Do. Deb.	68—71e	..	..
389,000	,,	Aug. 29	5	5	East Hull Ord. 5 p.c.	73—75	..	..
1,009,180	10	Sept. 12	†7	†4	European, Ltd.	13½—14½	+2½	11—13⅜
10,705,480	Stk	July 25	5⅜	5⅜	Gas Light & Coke 4 p.c. Ord.	17/6—18/6f	..	17/7½—18/3
2,400,000	,,	,,	8½	8½	Do. 8½ p.c. max.	60—62	..	61½
4,187,020	,,	,,	4	4	Do. 4 p.c. Con. Pref.	72—75	..	73—74½
9,609,690	,,	June 13	3	3	Do. 3 p.c. Con. Deb.	56—59	..	57½
9,442,770	,,	,,	5	5	Do. 5 p.c. Red. Deb.	97—100	..	98½—99½
88,500	,,	Aug 29	7	7	Hastings & St L. 5 p.c. Conv	98—103	..	..
368,740	,,	,,	5½	5½	Do. 3½ p.c. Conv.	77—82	..	..
70,000	10	Oct. 10	†10	†10	Hongkong & China, Ltd.	13½—14½	..	..
218,200	Stk.	Aug. 29	6	6½	Hornsey Con. 3½ p.c.	84—87	..	..
1,016,000	,,	Nov. 21	20	10	Imperial Continental Cap.	340 350*	+15	317—345
123,150	,,	Aug. 15	8½	8½	Do. 8½ p.c. Red. Deb.	71—76	..	..
285,342	,,	Aug. 15	7½	8	Lea Bridge 5 p.c. Ord.	115—118	..	..
2,145,907	,,	Aug. 15	6	6	Liverpool 5 p.c. Ord.	93 93½b	..	..
600,000	,,	Sept. 26	7	7	Do. 7 p.c. Red. Pref.	100½—102½b	..	..
165,756	,,	Aug. 29	8	9	Maidstone 5 p.c. Cap.	122—127	..	..
69,480	,,	June 27	3	3	Do. 3 p.c. Deb.	53—56	..	..
75,000	b	June 13	18	110	Malta & Mediterranean	5½—6	..	..
892,000	—	Oct. 1	5½	5½	Metrop'n (of Melbourne) 5½ p.c. Red. Deb.	94 95	..	93½—93½
841 920	Stk.	Nov. 21	19	16	Montevideo, Ltd.	103—106*	-2	..
4,051,818	,,	July 26	5⅜	5	Newcastle & Gateshead Con.	16 3—16/0½f	..	..
682,856	,,	,,	4	4	Do. 4 p.c. Pref.	71¾ 72¾d	+½	..
891,705	,,	June 27	8½	8½	Do. 8½ p.c. Deb.	66½—67¼d	..	..
181,780	,,	Aug. 29	7/1/0	7½	North Middlesex 5 p.c. Con	112—117	..	..
396,160	,,	Aug. 15	5	5	Northampton 5 p.c. max.	76—79	..	..
900.000	,,	Nov. 21	7	9	Oriental, Ltd.	108 115*	3	..
205,162	,,	June 27	8	8	Plym'th & Ston'house 5 p.c.	110 113	..	..
424,116	,,	Aug. 29	8½	8	Portsm'th Con. Stk. 4p.c. Std	113 118	..	..
241,146	,,	,,	5	5	Do. 5 p.c. max	80 83	..	..
2,334,464	1	June 27	—	†5	Primitiva Ord.	28/—31/-	+1/-	28/6—29/6
244,500	100	June 8	4	4	Do. 4 p.c. Red. Deb.	92—95	..	..
695,000	Stk.	July 25	4	4	Do. 4 p.c. Red. Deb. 1911	79—82	..	..
416,345	,,	June 27	4	4	Do. 4 p.c. Cons. Deb.	79—82	..	81½—81
150,000	10	Sept. 26	6	6	San Paulo 6 p.c. Pref.	8½—9	..	9
1,736,968	Stk	Aug. 29	6½	6½	Sheffield Cons.	105—107e	..	..
96,000	,,	July 11	4	4	Do. 4 p.c. Deb.	75—77e	..	..
90,000	10	June 13	†4	†4	South African	4—6	..	..
4,109,855	Stk.	July 26	7½	5	South Met. Ord.	93—101	..	99½—101
500,000	,,	,,	6	6	Do. 6 p.c. Irred. Pf.	106—109	..	106¼—107½
1,895,445	,,	July 11	3	3	Do. 3 p.c. Deb.	54—57	..	54½—56
784,000	,,	Sept. 12	6½	6½	Do. 6½ p.c. Red. Db.	98—100	..	99—99½
91,500	,,	Aug 15	8½	8½	South Shields Con.	109—111d	..	..
1,543,793	,,	July 25	6½	6½	South Suburban Ord. 5 p.c.	101—104	..	101½—102
468,837	,,	June 27	5	5	Do. 5 p.c. Deb.	94—97	..	..
547,740	,,	Aug. 15	5	5	South'mpton Ord. 5 p.c max.	77 80	..	..
191,976	,,	June 27	4	4	Do. 4 p.c. Deb.	70 73	..	..
179,014	,,	July 25	8	8	Sutton Ord.	116—119	..	..
67,838	,,	June 27	5	5	Do. 5 p.c. Deb.	90—93	..	..
360,000	,,	Feb. 21	7	7	Swansea 7 p.c. Red. Pref.	100—103	..	..
900,000	,,	June 27	6½	6½	Do. 6½ p.c. Red. Deb.	100—102	..	..
1,002,276	,,	Aug. 15	6⅔	6⅔	Tottenham District Ord.	101—106	..	105½
150,000	,,	,,	5½	5½	Do. 5½ p.c. Pref.	97—100	..	..
181,255	,,	June 13	4	4	Do. 4 p.c. Deb.	74—77	..	..
283,024	,,	Aug. 29	7	7	Uxbridge, Maidenhead, & Wycombe 5 p.c.	97—102	..	97½—98
88,830	,,	,,	5	5	Do. 5 p.c. pref.	85 90	..	..
80,000	,,	July 11	9	9	Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c.	35—140	..	..
255,838	,,	,,	7½	7½	Do. B 5½ p.c.	112—117	..	..
492,705	,,	,,	6⅔	6⅔	Do. C and New	95—100	..	..
382,000	,,	,,	7½	7½	Do. Wimbledon 5 p.c.	105—110	..	..
98,000	,,	,,	7⅝	7⅝	Do. Epsom 5 p.c.	113—118	..	..
60,000	,,	,,	5	5	Do. 5 p.c. Pref.	87—92	..	..
88,476	,,	June 27	3	3	Do. 3 p.c. Deb.	54—57	..	..
184,744	,,	,,	4	4	Do. 4 p.c. Deb.	74—77	..	..
307,200	,,	,,	5	5	Do. 5 p.c. Deb.	93—96	..	..

Quotations at: —a.—Bristol. b.—Liverpool. c.—Nottingham. d.—Newcastle. e.—Sheffield. f.—The quotation is per £1 of Stock. * Ex. div. † Paid free of income-tax. ‡ For year.

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(This announcement is inserted gratuitously.)

PETER—WITH ONE EXCEPTION

With one exception Peter is an ordinary little fellow. Chubby, likeable, just five-and-a-half, full of life and fun and on occasions—be it admitted—of naughtiness.

Just now Peter's rather important, for this is his first term at school, and he's grappling with the intricacies of "A B C" and "Twice Two": difficult subjects to all men of five-and-a-half, but even more difficult in Peter's case because—bad luck—he's totally blind. That's his One Exception.

Peter learns reading, writing, and 'rithmetic through the medium of "Braille"—dull stuff compared with the coloured picture books of most five-and-a-halfs. However, he's a stout lad is Peter, and he's making great progress.

Would you like to know more about him? How, in spite of his "One Exception," he is being educated, and, when older, technically trained and usefully employed.

There is a long waiting list of "Peters" throughout the British Isles, for whom training and accommodation must be provided in the immediate future.

Will you help with a donation or annual subscription? Any sum, large or small, will be gratefully received.

Here's a suggestion. Your eyesight is worth 3d. a year to you. Send Peter and his handicapped pals 3d. for every year you've had it. Now, please, in case it slips your memory. Good idea!

THE CHAIRMAN,
SCHOOL FOR THE BLIND
(Founded 1838),
Swiss Cottage, LONDON, N.W. 3

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Nov.* 25.

The only change of importance in the prices of tar products refers to creosote for export, the price of which is now about 6¼d. per gallon f.o.b.

Pitch remains 47s. 6d. per ton f.o.b.

As regards white spirits, pure toluole is now 2s. 4d. per gallon; 95/160 solvent naphtha remains about 1s. 5d.; pure benzole, about 1s. 11d.; and pyridine bases, 3s. 9d. to 4s. per gallon.

Tar Products in the Provinces.

Nov. 25.

There is nothing of interest to report in markets for tar products.

The average prices of gas-works products during the week were: Gas-works tar, 25s. to 30s. Pitch—East Coast, 47s. 6d. f.o.b. West Coast—(f.a.s.) Manchester, 42s. to 42s. 6d.; Liverpool, 45s. 6d. to 46s. 6d.; Clyde, 45s. 6d. to 46s. 6d. Toluole, naked, North, 1s. 7¼d. to 1s. 8¼d. Coal-tar crude naphtha, in bulk, North, 9d. to 10d. Solvent naphtha, naked, North, 1s. 3d. to 1s. 3½d. Heavy naphtha, North, 1s. to 1s. 0½d. Creosote, in bulk, North, liquid and salty, 3½d. to 3¾d.; low gravity, 2d. to 2¼d.; Scotland, 3¼d. to 3¾d. Heavy oils, in bulk, North, 5¾d. to 6d. Carbolic acid, 60's, 2s. 5¾d. to 2s. 6¼d. prompt. Naphthalene, £12 to £14. Salts, £5 to £5 10s., bags included. Anthracene, "A" quality, 2¼d. per minimum 40 p.ct., purely nominal; "B" quality, unsaleable.

Tar Products in Scotland.

GLASGOW, *Nov.* 23.

More business has been passing during the week, but prices remain unaltered in most products. Creosote oil to B.E.S.A. Specification is, if anything, lower; but grades containing acids are steady. Higher prices are being asked for pitch for the home trade.

Pitch.—The nominal price is unchanged at 45s. to 47s. 6d. per ton f.a.s. Glasgow, with about 5s. premium for local business.

Tar.—Some business is reported for delivery next season. The value is unaltered at 3¼d. to 4¼d. per gallon *ex* works in buyers' packages.

Creosote is slightly weaker. Gas-works and coke oven, 4¼d. to 4¾d. per gallon; light oils are 3¼d. to 4d. per gallon; neutral oil, 3¼d. to 4d. per gallon, all *ex* works.

Cresylic.—There is no change in the position. 97/99 p.ct. pale, 1s. 10d. to 1s. 11d. per gallon; 97/99 p.ct. dark, 1s. 9d. to 1s. 10d. per gallon; 99/100 p.ct. pale, 2s. 2d. to 2s. 3d. per gallon; high boiling, 2s. 1d. to 2s. 2d. per gallon.

Crude naphtha is scarce; but the value is unchanged at 6d. to 6¼d. per gallon, according to district.

Solvent naphtha is quiet. 90/160 is 1s. 1¼d. to 1s. 2¼d. per gallon; 90/190, 1s. 0¼d. to 1s. 1¼d. per gallon.

Motor benzole is 1s. 5¼d. to 1s. 6d. per gallon.

Pyridine is unaltered. 90/160 is 3s. 3d. to 3s. 6d. per gallon. There is no inquiry for the heavier grades.

Benzole Prices.

The following are considered to be the market prices to-day:

	s. d.	s. d.	
Crude benzole . . .	0 10	to 0 11	per gallon at works
Motor ,, . . .	1 5	,, 1 6	,, ,, ,,
90 p.ct. ,, . . .	1 7	,, 1 8	,, ,, ,,
Pure ,, . . .	1 10	,, 1 11	,, ,, ,,

"B.C.G.A." Advertising.—The designs for playing cards and bridge scorers recently issued by the British Commercial Gas Association are most attractive. Gas heating is the basis of the design.

Spring Rod Company has been registered, with a nominal capital of £2000, as manufacturers of drain rods, tools, flexible steel rods, tools for clearing gas and water mains and services, and drain-testing appliances.

Cheaper Gas for Chertsey.—The Chertsey Gas Company announce that from the reading of the meters for the December quarter, the price of gas will be reduced from 11¾d. per therm to 10¾d. This reduction is equal to 6d. per 1000 c.ft. A further cash rebate of 4d. in each 5s. will be made in the case of prepayment consumers.

Ludlow Gas Company's Dinner.—The annual dinner of the Ludlow Gas Company's Directors and employees was held recently at the Globe Hotel, Ludlow. Mr. R. B. Anderson gave the toast of "The Ludlow Union Gas Company," to which Mr. J. H. Paterson replied. The Directors were honoured by Mr. H. Living, and Mr. E. T. Evans replied.

Bromsgrove Public Lighting.—The Bromsgrove Gaslight and Coke Company have again received the contract from the local Urban District Council for the public lighting, in competition with the Electrical Company. New lamp heads have recently been fixed in the main streets, each lamp having a burner with four bijou mantles. In a recent summons against a motorist for not having two front lights on his car, defendant said he did not notice that his offside lamp had gone out, because the town of Bromsgrove was so well lighted!

Selling After Hours.

A general movement is now afoot among shopkeepers to keep their windows lighted up until 10 o'clock each evening, despite the fact that their shops are closed at 6 or 7 o'clock. They are finding not only that their action is appreciated, but that, for the small expenditure involved in the cost of illumination, it is a paying proposition. They are also discovering that it is advisable to have more powerful illumination than that to which we have been accustomed during the last few years. Many enterprising shopkeepers in London and the Provinces are now combining in their efforts to stimulate business in their districts by these means and also by the adoption of a co-operative system of shop parade lighting, using powerful high-pressure gas lamps of standard design and candle-power as the illuminant. Thus the general appearance of the row of shops is greatly improved, and the mass effect of the series of brilliant lighting units attracts crowds to the neighbourhood. The current issue (No. 188) of "A Thousand-and-One Uses for Gas" contains some striking examples of shop parade lighting which have been installed in London during recent months, a number of them replacing electric lighting.

Podmore's has been registered, with a nominal capital of £5000, as manufacturers of gas and electric heating, lighting, and cooking apparatus, metal spinners, and sheet metal workers, now carried on at 34, Charles Street, Hatton Garden, London, E.C.

Proposed Purchase of Biggar Gas-Works.—The Biggar Town Council is considering an offer by the local Gas Company to sell its works for £5000, and if the Council can see their way to make gas cheaper than it is at present without requiring at the same time to buy new plant of any kind, it is possible that the Council will desire to acquire and manage the gas undertaking.

Eastbourne Gas Company.—The third annual co-partnership dinner was held on Nov. 21, under the chairmanship of Mr. Frank H. Jones, Chairman of Directors. It was mentioned during the course of the evening that the number of co-partners in the Company is now 239, holding nearly £29,000 stock. During the past year, £1600 was invested in the Company by co-partners out of their own savings.

Is Rubber Tubing a Pipe?—A fine of £5 was imposed on Arthur Seagust, of Green Street Green, Kent, at the Bromley Police Court, for unlawfully laying, or causing to be laid, a rubber tubing to communicate with a pipe belonging to the South Suburban Gas Company, without their consent. In evidence, Edwin Phillips, a collector of the Gas Company, stated that the premises had been supplied with gas, but the supply was discontinued and the meter removed when the last tenant left. When he visited the house on Oct. 21, he found the cap closing the Company's pipe could be unscrewed by hand, and there was a smell of gas. He also noticed some gas fittings in the house. He arranged for observation to be kept, and on Oct. 28 he again visited the premises, and found the Company's pipe and the house pipes connected by a rubber tube. Defendant pleaded not guilty, stating that he was an electrician, and did not want gas. Also the Act said that "rubber tubing" was not "pipe," and he asked for an adjournment. The Bench, however, considered the case proved and imposed the fine referred to.

Metals Coating Company.—A British monopoly in the field of metal-coating is foreshadowed in the formation of the Metals Coating Company, Ltd., which has been organized to acquire the assets of Metallisation, Ltd., Dudley, and Metallisation (Sales), Ltd., London, firms which control the sales and contracting rights in the British Isles and India of a process for coating any metallic or non-metallic surface with any metal that can be drawn into wire or obtained in powder form. The Company, which has an authorized capital of £150,000 divided into 600,000 shares of 5s. each, holds a six months' option to acquire 91 p.ct. of the issued ordinary share capital of the Metals Coating Company of America, Inc., which controls Metallisator A.G. of Berlin, and Metallisator A.G. of Hamburg, three Companies which, together with the British firms now being acquired, between them control the world rights for the manufacture, sales, and contracting licences of the metal-spraying pistol which is widely used in industry throughout the world. Permission to deal in the Metals Coating shares has been granted by the Stock Exchange, and the shares are now quoted.

Prize Essay Competition.—The "Journal of Careers," in conjunction with the Economic League, are organizing an essay competition. The subject of the essay will be, "What I Want to be and Why." The conditions of the competition are: (1) That essays shall be approximately 500 words in length; (2) the age of entrants shall be 16 to 19; (3) each essay must be certified by a headmaster or other responsible person to be the competitor's own work, and the candidate's age must also be certified by the same authority; (4) entries must be sent in, with entry form, not later than Saturday, Dec. 21, 1929; (5) entries should be marked "Essay" on the envelope, and should be sent to the Editor, the "Journal of Careers," 61, Conduit Street, W. 1; (6) the right of publication of successful or any essays is reserved. The judges will be Mr. Archibald Crawford, K.C., Director of the Economic League; Sir Charles Wakefield, Bart.; and the Editor of the "Journal of Careers." An entry form is published in the October and November issues of the "Journal of Careers." The awards will be as follows: A first prize of £100, given by Sir Charles Wakefield, Bart. Four second prizes of £25 each, given by Sir Harry McGowan, K.B.E., of Imperial Chemical Industries, Ltd.; by Sir William Crawford, K.B.E.; by the Economic League; and by the "Journal of Careers." A number of third prizes of £5 each.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer—not necessarily for publication but as a proof of good faith.

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Orders to Alter or Stop PERMANENT ADVERTISEMENTS should be received by the FIRST POST on Monday.

UNDISPLAYED ADVERTISEMENTS: Situations Wanted, Six Lines and under (about 36 words), 3s.; each additional Line, 6d. Situations Vacant, Apparatus Wanted and for Sale, Contracts, Public Notices, &c., 9d. per Line—minimum, 4s. 6d. An additional charge of 6d. is made where replies are addressed c/o the "JOURNAL."

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THE "GAS SALESMAN."

The "GAS SALESMAN" is included as a supplement to the "JOURNAL" eighteen times a year—twice a month from October to March, and once a month from April to September. Additional copies are also obtainable at the following rates: Annual Subscription 6/-, post free, payable in advance. Single copies (by post) 4½d. In Bulk for Distribution among Gas Service Staffs—100 copies of each issue, 30/-; 50 copies, 16/-; 25 copies, 8/-; 12 copies, 4/-, all plus carriage.

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Applicants must be experienced in the Design and Specification of all plant for the Manufacture of Gas and the Handling of Materials, and will be required to act as Clerk of Works during the Erection of the Plant.
Applications to be received not later than Tuesday, December 10th, giving Age, Details of Experience, Salary required, and also *copies* of Testimonials, to No. 8014, "GAS JOURNAL," 11, BOLT COURT, FLEET STREET, E.C. 4.

COUNTY BOROUGH OF BLACKPOOL.
(GAS DEPARTMENT.)

WANTED a Chemist qualified to carry out all Tests associated with Gas-Works Practice. Salary commencing £180 per Annum, with four increments to £240 per Annum, subject to deductions under the Local Government and other Officers' Superannuation Act, 1922.
Medical examination necessary.
Applications, accompanied by *copies* of Three recent Testimonials and stating Age, Qualifications, and Particulars of Training, to be addressed to the undersigned not later than the 7th of December, 1929.

JOHN H. CHEW,
Engineer and Manager.

Gas Offices,
Princess Street,
Blackpool,
Nov. 22, 1929.

HARTLEPOOL GAS AND WATER COMPANY.

APPLICATIONS are invited for the position of CHIEF WORKS ASSISTANT, to be responsible to the Chief Engineer for the conduct of the two Gas-Works and the Pumping Station of the Company.
Applicants, who should preferably be not more than 35 years of Age, may obtain a list of duties, together with the conditions of the Appointment from the undersigned, and applications should be in his hands not later than Dec. 10, 1929.

J. R. BRADSHAW,
Secretary.

West Hartlepool,
Nov. 22, 1929.

WANTED Deputy Works Foreman, S.E. Coast Town. Thorough knowledge of Gas-Works Routine, including C.W.G. Manufacture. Only thoroughly Competent Men need Apply. Co-partnership and Pension Schemes in operation.
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GASHOLDER.—Spiral Guided 100,000 c.ft. capacity, and Steel Tank, with cup. New Outer Lift could be supplied to make capacity 200,000 c.ft. Attractive price for prompt acceptance.
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Retort Ironworks for beds of 4's, 5's, 6's, 7's, and 8's. 22 in. by 16 in. Self-Sealing Mouthpieces. 6 in. Ascension Pipes and all to follow.
Washers and Tar Extractors—Livesey and Cripps type. 2 million, 500,000, 400,000, 250,000, 200,000, 150,000 and 100,000 c.ft. per day.
Exhausting Sets.—Steam and Gas Engine-driven, 5000 to 40,000 c.ft. per hour capacity.
Storage Tanks—Large number in Stock (Rectangular and Cylindrical). Tar Stills, &c.

Tar and Liquor Pumps, Steam and Belt-Driven.
Air Receivers, Fans, Blowers, Valves, Rivetted Tubes.

Firth Blakeley, Sons, & Co., Ltd.
(Second-Hand Plant Dept.),
Vulcan Ironworks, Church-Fenton, Leeds.
Telephone: 14, South Milford. Telegrams: Blakeleys Church-Fenton.

CAST-IRON PIPES FOR SALE.

British Manufacture to B.S.S. Specification.

SPIGOT AND FAUCET PIPES.

Size.	Number Available.	Length.
3 in.	8	9 ft.
4 ,,	208	9 ,,
6 ,,	166	9 ,,
8 ,,	139	9 ,,
8 ,,	107	12 ,,
12 ,,	34	12 ,,
15 ,,	58	12 ,,

and SPECIALS.

FLANGED PIPES.

Size.	Number Available.	Length.
4 in.	84	9 ft.
6 ,,	135	9 ,,

and SPECIALS.

Ready for Immediate Delivery. Keen prices for large quantities.
We supply all classes of TUBES and FITTINGS, including Weldless Steel Spigot and Faucet Wrapped Tubes.
Please send us your inquiries!
GEO. COHEN, SONS, & CO., LTD., 600, COMMERCIAL ROAD, LONDON, E. 14.

BEAUMONTS, of Bow, have for Immediate Delivery:
BRIQUETTING PLANT, producing 30 cwt. of semi-Ovoids per hour from small Breeze, Slack, and Binder. Plant has been thoroughly Tested, is practically new, and produces a perfect Briquette from Gas-Works waste.
BLOWERS, 9 in. discharge, by Jenkins, direct driven to 7 H.P. Motor by Mather & Platt, 240 D.C.
HEATERS OR CONDENSERS, 13½ ft. by 4½ ft. dia., with 200 Tubes. All Steel Construction.
SHELL TANK, 14 ft. by 4½ ft. dia. dished ends.
Several BOILER TANKS, 30 ft. by 8 ft.
GASHOLDER, 160,000 c.ft. Capacity. Two Lifts.
STATION METERS—8, 12, and 15 in. Main Connections.
Several BOILERS, STEAM & GAS ENGINES, STEAM FEED & SINKING PUMPS, EXHAUSTERS, SCRUBBERS, PURIFIERS, SULPHATE PLANT, &c.
Send us your enquiries.
W. G. BEAUMONT & SON, PRIORY WORKS, BOW, LONDON, E. 3.
(Percy E. Beaumont). Established 1892. The Original Firm.
'Phones, East 0379/4410. Wires, Norustbeau, London.

BEAUMONTS, of Bow, will Purchase:
All your SCRAP MATERIAL, and take Delivery from your Works, giving a real Clearance.
FERROUS and NON-FERROUS METALS, OLD PLANT, DISUSED HOLDERS, Beds of RETORTS, OLD BUILDINGS.
We REPAIR CHIMNEYS, Supply and Fix LIGHTNING CONDUCTORS.
DEMOLISH or DISMANTLE any STRUCTURE, including STACKS, TOWERS, and any Erection requiring Steeplejack Service.
We undertake Unusual Services, and deal with Demands from Works for Labour unsuited to Standard Staffs.
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FIRTH BLAKELEY, SONS, & CO., LTD., Second Hand Plant Department, CHURCH-FENTON, *via* LEEDS.

FOR HIRE—Several 14-ton Cylin-drical Steam Coil RAIL TANK-WAGONS suitable for Tar, Creosote, &c.
Address, No. 7994, "GAS JOURNAL," 11, BOLT COURT, FLEET STREET, E.C. 4.

CONTRACTS OPEN.

CITY OF BRADFORD.
(GAS DEPARTMENT.)

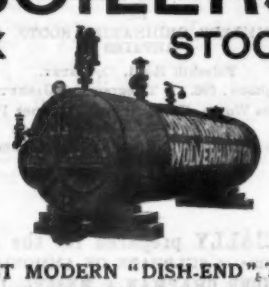
TENDERS are invited for the Supply and Erection of a GASHOLDER (for use as C.W.G. Relief Holder) of a capacity of ½ Million Cubic Feet, at the Valley Road Works of the Department.
Applications for copies of Specification and Form of Tender should be made to the Gas Engineer, Town Hall, Bradford, before the 4th of December, 1929.
Tenders on the prescribed Forms, sealed and endorsed "Tender for Gasholder," must be Delivered by post to the undersigned not later than noon on Tuesday, Dec. 10, 1929.

N. L. FLEMING,
Town Clerk.

Town Hall, Bradford,
Nov. 22, 1929.

MACHINED BRASS WORK, &c.
HOT BRASS PRESSINGS
Capstan Lathe work, Burner Regulators, Metal Spinnings, Press work.
ELM WORKS, Ltd., Summerstown, S.W. 17.

NEW "THOMPSON"
BOILERS
EX STOCK.



MOST MODERN "DISH-END" TYPE
WITH CORRUGATED SECTIONS.

	W.P.	Shop No.
Two 30 ft. by 9 ft. 3 ins. by	200 lbs.	6947/8
One 30 ft. by 9 ft. 3 ins. by	180 lbs.	6862
Two 30 ft. by 9 ft. 3 ins. by	160 lbs.	6848/9
One 30 ft. by 8 ft. 6 ins. by	120 lbs.	6812
One 30 ft. by 8 ft. 6 ins. by	160 lbs.	6826
Two 30 ft. by 8 ft. 3 ins. by	160 lbs.	6871/2
Two 30 ft. by 8 ft. 3 ins. by	120 lbs.	6930/1
One 30 ft. by 8 ft. 0 ins. by	180 lbs.	6875
One 28 ft. by 7 ft. 6 ins. by	160 lbs.	6785

All the above Boilers are built from "Siemens Martin" Acid Steel.
SUPERHEATERS AND PIPEWORK INSTALLATIONS.
Repairs to all types of Boilers by first-class men.
JOHN THOMPSON
(WOLVERHAMPTON) LTD.,
WOLVERHAMPTON, ENG.